THE

SILVA OF NORTH AMERICA

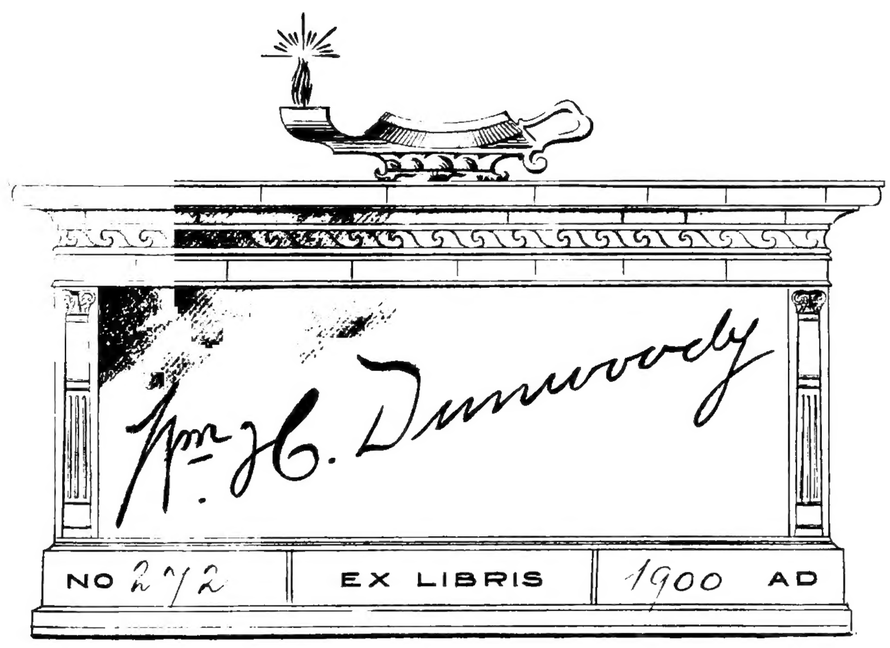
BY

CHARLES SPRAGUE SARGENT

THE NEW YORK BOTANICAL GARDEN
LuEsther T. Mertz Library

Gift of

The Estate of
Henry Clay Frick, II
2007



THE

SILVA OF NORTH AMERICA

A DESCRIPTION OF THE TREES WHICH GROW NATURALLY IN NORTH AMERICA EXCLUSIVE OF MEXICO

BY

CHARLES SPRAGUE SARGENT

DIRECTOR OF THE ARNOLD ARBORETUM
OF HARVARD UNIVERSITY

Illustrated with Figures and Analyses drawn from Nature

BY

CHARLES EDWARD FAXON

VOLUME VIII

CUPULIFERÆ

(*Quercus*)

BOSTON AND NEW YORK
HOUGHTON, MIFFLIN AND COMPANY
The Riverside Press, Cambridge
MDCCCXCV

Copyright, 1895,
By CHARLES SPRAGUE SARGENT.

All rights reserved.

The Riverside Press, Cambridge, Mass., U. S. A.
Electrotyped and Printed by H. O. Houghton and Company.

MERTZ LIBRARY
NEW YORK
BOTANICAL
GARDEN

TO THE MEMORY OF

ANDRÉ AND FRANÇOIS ANDRÉ MICHAUX,

FATHER AND SON,

WHOSE LONG AND ARDUOUS JOURNEYS

IN THE TRACKLESS FORESTS OF THE NEW WORLD

LAID THE FOUNDATION OF KNOWLEDGE

WITH REGARD TO THE OAKS OF EASTERN AMERICA,

THIS EIGHTH VOLUME OF

THE SILVA OF NORTH AMERICA

IS DEDICATED.

TABLE OF CONTENTS.

		Page
Synopsis of Orders		vii
Quercus alba	Plates cccclvi., cccclvii., cccclviii.	16
Quercus alba × minor	Plate cccclix.	18
Quercus alba × macrocarpa	Plate cccclx.	18
Quercus alba × Prinus	Plate cccclxi.	18
Quercus lobata	Plate cccclxii.	23
Quercus Breweri	Plate cccclxiii.	27
Quercus Garryana	Plates cccclxiv., cccclxv.	29
Quercus Gambelii	Plates cccclxvi., cccclxvii.	33
Quercus minor	Plates cccclxviii., cccclxix.	37
Quercus Chapmani	Plate cccclxx.	41
Quercus macrocarpa	Plates cccclxxi., cccclxxii., cccclxxiii.	43
Quercus lyrata	Plate cccclxxiv.	47
Quercus Prinus	Plates cccclxxv., cccclxxvi.	51
Quercus acuminata	Plate cccclxxvii.	55
Quercus prinoides	Plate cccclxxviii.	59
Quercus Sadleriana	Plate cccclxxix.	61
Quercus platanoides	Plates cccclxxx., cccclxxxi.	63
Quercus Michauxii	Plates cccclxxxii., cccclxxxiii.	67
Quercus breviloba	Plate cccclxxxiv.	71
Quercus undulata	Plate cccclxxxv.	75
Quercus Douglasii	Plate cccclxxxvi.	79
Quercus Engelmanni	Plate cccclxxxvii.	83
Quercus oblongifolia	Plate cccclxxxviii.	87
Quercus Arizonica	Plate cccclxxxix.	89
Quercus reticulata	Plate ccccxc.	91
Quercus Toumeyi	Plate ccccxci.	93
Quercus dumosa	Plates ccccxcii., ccccxciii.	95
Quercus Virginiana	Plates ccccxciv., ccccxcv., ccccxcvi.	99
Quercus Emoryi	Plate ccccxcvii.	103
Quercus chrysolepis	Plates ccccxcviii., ccccxcix., cccc., ccccci.	105
Quercus tomentella	Plate cccccii	109
Quercus agrifolia	Plate cccciii.	111
Quercus pumila	Plate cccciv.	115
Quercus hypoleuca	Plate cccccv.	117
Quercus Wislizeni	Plate ccccvi.	119
Quercus Wislizeni × Californica	Plate ccccvii.	120
Quercus myrtifolia	Plate ccccviii.	123
Quercus rubra	Plates cccccix., ccccx.	125
Quercus Texana	Plate ccccxi.	129
Quercus coccinea	Plates ccccxii., ccccxiii	133
Quercus velutina	Plates ccccxiv., ccccxv.	137
Quercus Californica	Plate ccccxvi.	141
Quercus Catesbæi	Plate ccccxvii.	143
Quercus Catesbæi × nigra	Plate ccccxviii.	144

QUERCUS CATESBÆI × LAURIFOLIA	Plate ccccxix.	144
QUERCUS DIGITATA	Plates ccccxx., ccccxxi.	147
QUERCUS PALUSTRIS	Plates ccccxxii., ccccxxiii.	151
QUERCUS NANA	Plate ccccxxiv.	155
QUERCUS GEORGIANA	Plate ccccxxv.	159
QUERCUS MARILANDICA	Plates ccccxxvi., ccccxxvii.	161
QUERCUS NIGRA	Plate ccccxxviii.	165
QUERCUS LAURIFOLIA	Plates ccccxxix., ccccxxx.	169
QUERCUS BREVIFOLIA	Plate ccccxxxi.	171
QUERCUS IMBRICARIA	Plate ccccxxxii.	175
QUERCUS IMBRICARIA × MARILANDICA	Plate ccccxxxiii.	176
QUERCUS IMBRICARIA × COCCINEA	Plate ccccxxxiv.	176
QUERCUS PHELLOS	Plate ccccxxxv.	179
QUERCUS PHELLOS × VELUTINA	Plate ccccxxxvi.	180
QUERCUS PHELLOS × MARILANDICA	Plate ccccxxxvii.	181
QUERCUS DENSIFLORA	Plate ccccxxxviii.	183

SYNOPSIS OF THE ORDERS OF PLANTS CONTAINED IN VOLUME VIII. OF THE SILVA OF NORTH AMERICA.

CLASS I. **DICOTYLEDONOUS or EXOGENOUS PLANTS.**

Stems increasing in diameter by the annual addition of a layer of wood inside the bark. Leaves netted-veined. Embryo with a pair of opposite cotyledons.

SUB-CLASS I. **Angiospermæ.** Pistil, a closed ovary containing the ovules and developing into the fruit.

DIVISION III. **Apetalæ.** Corolla 0. Stamens inserted on the petaloid calyx, or hypogynous.

51. **Cupuliferæ.** Flowers monœcious or rarely perfect. Stamens 2 to 4 or indefinite. Ovary inferior, after anthesis imperfectly 2 to 3 or rarely 4 to 6-celled. Ovule solitary, or in pairs, ascending or descending, anatropous. Fruit a nut usually more or less inclosed in bracts free or united into a woody involucre. Leaves alternate, stipulate.

SILVA OF NORTH AMERICA.

QUERCUS.

FLOWERS unisexual or rarely perfect, monœcious, apetalous, in unisexual or androgynous spikes or aments; calyx 4 to 7-lobed, the lobes imbricated in æstivation; stamens generally 6; pistillate flower surrounded by an involucre of imbricated scales; ovary inferior, usually incompletely 3-celled; ovules 2 in each cell, ascending or descending. Fruit a nut surrounded at the base or embraced in the accrescent woody involucre. Leaves alternate, annual, or perennial, penniveined, stipulate.

Quercus, Linnæus, *Gen.* 291 (1737). — Adanson, *Fam. Pl.* ii. 375. — A. L. de Jussieu, *Gen.* 410. — Endlicher, *Gen.* 274. — Meisner, *Gen.* 346. — Baillon, *Hist. Pl.* vi. 256. — Bentham & Hooker, *Gen.* iii. 407. — Prantl, *Engler & Prantl Pflanzenfam.* iii. pt. i. 55.

Lithocarpus, Blume, *Bijdr. Fl. Ned. Ind.* 526 (1825). — Endlicher, *Gen.* 275. — Meisner, *Gen.* 346.

Synædrys, Lindley, *Introd. Nat. Syst.* ed. 2, 441 (1836). — Meisner, *Gen.* 346. — Hance, *Hooker Jour. Bot. and Kew Gard. Misc.* i. 175.

Cyclobalanopsis, Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 77 (*Bidrag til Egeslægtens Systematik*) (1867); *Vidensk. Selsk. Skrift. Nat. Math.* ser. 5, ix. 371 (*Bidrag til Kundskab om Egefamilien i Nutid og Fortid*); *Liebmann Chênes Am. Trop.* 19.

Cyclobalanus, Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 80 (*Bidrag til Egeslægtens Systematik*) (1867); *Vidensk. Selsk. Skrift. Nat. Math.* ser. 5, ix. 375 (*Bidrag til Kundskab om Egefamilien i Nutid og Fortid*); *Liebmann Chênes Am. Trop.* 20.

Pasania, Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 81 (*Bidrag til Egeslægtens Systematik*) (1867); *Vidensk. Selsk. Skrift. Nat. Math.* ser. 5, ix. 373 (*Bidrag til Kundskab om Egefamilien i Nutid og Fortid*); *Liebmann Chênes Am. Trop.* 20. — Prantl, *Engler & Prantl Pflanzenfam.* iii. pt. i. 55.

Trees or shrubs, with astringent properties, watery juices, stellate pubescence, pale and scaly or dark and furrowed bark, hard and close-grained or brittle and porous wood, terete branchlets, buds[1] covered by numerous imbricated scales, thick perpendicular tap-roots penetrating deep into the ground, stout wide-spreading horizontal roots and few thick rootlets, and in some species long proliferous stolons. Leaves simple, alternate, five-ranked, variously folded in the bud, lobed, dentate, spinescent or entire, often polymorphous on the same branch, membranaceous or coriaceous, petiolate, penniveined, the primary veins prominent and extending to the margins or united within them and connected by more or less reticulate veinlets, deciduous in the autumn or persistent until spring, or until their third or fourth year; leaf-scars broader than high, slightly elevated, semiorbicular, more or less obcordate, marked with the ends of numerous scattered fibro-vascular bundles. Stipules obovate or lanceolate, scarious, caducous or those of the upper leaves sometimes persistent during the winter. Flowers monœcious, unisexual, or rarely perfect, anemophilous. Staminate flowers (Lepidobalanus) solitary, subtended by lanceolate acute caducous bracts, or ebracteate, in graceful pendulous clustered aments from separate or leafy buds in the axils of leaves of the previous year or from the axils of the inner scales of the terminal bud or from those of leaves of the year; or (Pasania) in a three to five-flowered cyme in the axil

of a persistent bract, the lateral flowers subtended by similar although smaller bracts, in erect unisexual or androgynous spikes from the axils of leaves of the year or rarely of the previous year. Calyx campanulate, lobed or divided to the base into from four to seven, usually into six, membranaceous lobes or segments. Stamens indefinite, generally from four to six or sometimes ten or twelve; filaments inserted on the slightly thickened torus, free, filiform, exserted; anthers ovate, oblong or rarely subglobose, glabrous or rarely pilose, attached on the back, two-celled, the cells parallel, contiguous, opening longitudinally. Ovary obsolete, or (Pasania) rudimentary, minute and pilose. Pistillate flower solitary, subtended by a caducous bract, bibracteolate, in short or elongated few-flowered spikes from the axils of leaves of the year, or in some species of Pasania scattered at the base of the staminate inflorescence. Calyx usually urceolate, the tube adnate to the ovary, with a short campanulate limb, generally six-lobed or obscurely dentate. Staminodia minute, usually obsolete (Lepidobalanus), or in some species of Pasania developed into abortive stamens inserted on and as many as the lobes of the calyx. Ovary inferior, incompletely three or rarely four or five-celled by the development from the bottom, after fecundation, of thin partitions, inclosed more or less completely by an accrescent scaly involucre; styles as many as and superposed to the cells of the ovary, short or elongated, erect or recurved, terete, or dilated or clavate above, stigmatic on the inner face or at the apex only, generally persistent on the fruit; ovules two in each cell, attached on its inner angle at or above the base, or suspended near the apex, anatropous or semianatropous; micropyle superior. Nut or gland maturing in one or in two years, ovoid, globose, or turbinate, umbonate at the apex, one-seeded by abortion, surrounded at the base or inclosed in the accrescent cupular involucre of the flower, attached by a large conspicuous raised or depressed circular umbilicus at the base, or (Lithocarpus) by the sides also. Pericarp crustaceous or coriaceous, or rarely thick, indurate, granular or bony, indehiscent, of two coats, the inner (Lepidobalanus) thin and membranaceous, or thicker and coated on the inner surface with pale tomentum. Involucral cup woody, free from the nut except at the base, or adnate to it throughout and indehiscent, its scales imbricate, thin or thickened and turbinate or often developed into teeth or spines, or united into crenulate or dentate zones. Seed filling the cavity of the nut, marked at the base or at the apex, or rarely on the side with the abortive ovules, hypogæous in germination.[2] Cotyledons thick and fleshy, usually plano-convex and entire, undulate on the back or rarely sinuately lobed, or occasionally united into a solid mass; radicle minute, superior, included within the base of the cotyledons; hilum minute, basal or apical.[3]

Nearly three hundred species of Quercus have been described.[4] Inhabitants of the temperate regions of the northern hemisphere, they occur also at high altitudes within the tropics, ranging south to the mountains of Colombia in the New World and to those of the Indian Archipelago in the Old World, where, a few degrees below the equator, they find their most southern home. The genus has no representative in central and southern Africa, in South America beyond Colombia, or in the islands of the Pacific, in New Guinea, or Australia. The great centres of distribution of Quercus are the highlands of Central America and Mexico,[5] whence it spreads southward with a few species, and northward to British Columbia and the valley of the St. Lawrence River; and the Indian Archipelago and Malaya,[6] whence it ranges to the Philippine Islands[7] and through China[8] and Japan[9] to Saghalin[10] and Manchuria,[11] through southern India and along the Himalayas[12] to western Asia,[13] where many species occur, and through the Mediterranean basin[14] to western and northern Europe, where Quercus is less prolific in species than in other equally temperate regions of the northern hemisphere. In North America, exclusive of Mexico, fifty species of Quercus are now distinguished.[15] With four exceptions they all, under favorable conditions, sometimes assume the habit of trees; among them are some of the largest and most valuable deciduous-leaved timber-trees of the continent; and in both the eastern and extreme western parts of the country Quercus is often the most conspicuous feature of vegetation.[16] In eastern America at the extreme northern limits of its range the genus is represented by a single species; the number gradually increases under the influence of a less rigorous climate, and in

southern New England ten occur. They then gradually increase southward in numbers, and in the coast region of the south Atlantic and Gulf states nineteen species are found collected together. This is the greatest aggregation of species in the United States, although in the central Mississippi valley Oak-trees are more abundant and grow to a larger size than in any other part of North America. Absent from the high, dry, and cold mid-continental plateau, Quercus reappears on the lower slopes of the southern Rocky Mountains, which are often covered with vast thickets of *Quercus Gambelii*, a species peculiar to the interior of the continent. Farther south this is joined by another species; and on the mountains of western Texas, southern New Mexico and Arizona, six Oak-trees of the Mexican forests find their northern home. Extremely rare in the arid region between the Rocky Mountains and the Sierra Nevada, where Quercus is represented only by stunted bushes clinging to the upper slopes of the mountain ranges, it is often an important element in the forests nourished by the more humid atmosphere of the Pacific coast, especially in the valleys of central California. Reaching British Columbia and Washington with a single species, the number gradually increases southward, five species occurring in southern Oregon and thirteen in California.

The type is an early one. The ancestors of existing European species inhabited that continent during the late cretaceous and tertiary periods,[17] when Quercus was also widely distributed in North America, ranging in the centre of the continent far to the north of its present home, and reaching its fullest development during the upper miocene and the eocene epochs.[18]

Oak-trees, especially the species of Lepidobalanus with annual fructification, produce strong tough durable timber.[19] The most valuable timber-trees of the genus are the White Oaks and the Live Oak of eastern North America, the European and Asiatic *Quercus Robur*,[20] *Quercus Lusitanica*[21] of the Mediterranean basin, *Quercus dilatata*[22] of the northwest Himalayas, *Quercus Griffithii*[23] of Sikkim and Boutan, and *Quercus Mongolica*[24] of northeastern Asia. The wood of most of the species makes excellent fuel, and it is often manufactured into charcoal. The tannic acid[25] contained in the bark of Oak-trees makes that of many species valuable for tanning leather.[26] Among the most useful for this purpose are the European *Quercus Robur*, *Quercus Cerris*,[27] *Quercus Ilex*,[28] and *Quercus Toza*,[29] the eastern American *Quercus velutina* and *Quercus Prinus*, and the western American *Quercus densiflora*. The large fleshy seeds of some of the species, although slightly astringent, are eaten by man, and are often used for fattening hogs. Those most palatable to man are produced by *Quercus Ilex*, var. *Ballota*, of the Iberian peninsula and northern Africa, *Quercus Ægilops*[30] of the Orient, *Quercus Emoryi* of the southwestern United States and northern Mexico, and *Quercus Michauxii* of the southeastern United States, although the North American Indians used the acorns of many other species in the eastern[31] and western[32] parts of the country. Cork is the bark of *Quercus Suber*[33] of the western countries of the Mediterranean basin, and of *Quercus occidentalis*,[34] an inhabitant of Portugal, Spain, and southwestern France. Galls caused by the punctures of different insects are produced on the branches of most Oak-trees, and are sometimes important articles of commerce.[35] From a parasitic insect that inhabits the leaves and branches of *Quercus coccifera*[36] of the Mediterranean basin kermes, a scarlet dye, is obtained. In the United States a decoction of the bark of the young branches of *Quercus alba* is used in external medicinal applications and sometimes internally in the treatment of hemorrhage or dysentery.[37] The bark of *Quercus Robur* is employed in medicine as an astringent,[38] and the acorns sometimes supply a tonic and astringent, and a remedy for scrofula.[39] In China and Japan coarse silk[40] is made from the cocoons of larvæ fed on the leaves of *Quercus Mongolica*, *Quercus dentata*,[41] *Quercus serrata*,[42] and *Quercus Bungeana*;[43] and in India a wild silk-worm[44] feeds on the leaves of *Quercus incana*[45] of the northwestern Himalaya. From time immemorial *Quercus Robur*, the symbol of strength and longevity, has been venerated. It is the great ornament of European parks,[46] and for centuries European foresters have devoted their highest skill to producing the timber of this tree. In the southeastern United States Oaks are largely used to shade city streets and country mansions;[47] and the groves which surround the temples of southern Japan are chiefly

composed of the evergreen *Quercus glauca*,[48] *Quercus acuta*,[49] *Quercus glabra*,[50] and *Quercus cuspidata*.[51]

In the United States Quercus is preyed upon by many insects,[52] and is attacked by numerous fungal diseases.[53] Oak-trees can easily be raised from seeds, which must not be allowed to become dry before they are planted, as they soon lose their vitality.[54] Their long stout tap-roots make the operation of moving Oak-trees difficult, and only young specimens can be successfully transplanted.[55]

Quercus, the classical name of the Oak-tree, was adopted by Linnæus, who united in it the *Quercus*, *Ilex* and *Suber* of Tournefort.[56]

[1] The buds in the section Lepidobalanus are clustered at the end of the branches and are somewhat five-angled, covered with numerous chestnut-brown membranaceous slightly accrescent caducous scales keeled on the back, closely imbricated in five ranks, and often inclosing minute leaves. They represent morphologically stipules, and in falling mark the base of the branch with their ring-like scars. On vigorous shoots the terminal and axillary buds are often accompanied by minute lateral buds. On *Quercus Cerris* of southern Europe and some allied species the buds are surrounded by linear-lanceolate loosely imbricated or free scales and by the persistent stipules of the upper leaves; in Pasania the buds are covered with fewer erect or spreading foliaceous scales (Henry, *Act. Nat. Cur.* xviii. 531, t. 40; xxii. 337, t. 32. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 26, f. 1 [*Bidrag til Egeslægtens Systematik*]; *Liebmann Chênes Am. Trop.* 6, f. 1).

[2] The radicle is imbedded near the apex of the seed between the fleshy cotyledons with the minute plumule or growing point between their petioles toward the middle of the seed, the radicle in the North American Black Oaks and in a few of the White Oaks being longer than the petioles of the cotyledons, and shorter in most of the White Oaks. In germination the petioles of the cotyledons with the plumule lengthen, pushing the plumule outside the cracked shell of the nut within which the cotyledons remain; and from between the bases of the petioles the plumule develops into the ascending axis of the plant, which is covered in its lower nodes with minute scales or rudimentary leaves, and is nourished by the food contained in the cotyledons, which rot and disappear toward the end of the first season after the radicle, by absorbing some of their nutritious matter, has become swollen and enlarged (Engelmann, *Trans. St. Louis Acad.* iv. 190. — Marshall F. Ward, *The Oak*, 18, f. 3, 4).

[3] The species of Quercus have been grouped under the following sections: —

Lepidobalanus (Endlicher, *Gen.* Suppl. iv. pt. ii. 24. — A. de Candolle, *Arch. Sci. Phys. et Nat. de Genève*, nouv. pér. xv. 96. — G. King, *Ann. Bot. Gard. Calcutta*, ii. 21 [*Indo-Malayan Species of Quercus and Castanopsis*] — [Sec. Robur, Cerroides, Erythrobalanos, Cerris, Gallifera, Suber, Coccifera, Spach, *Hist. Vég.* xi. 148. — Sec. Esculus and Ilex, Gay, *Ann. Sci. Nat.* sér. 4, vi. 239, 242]). Staminate flowers on slender pendulous clustered aments from separate or leafy buds in the axils of leaves of the previous year or from the axils of the inner scales of terminal buds and at the base of shoots of the year or from the axils of leaves of the year, the flowers solitary in the axils of lanceolate caducous bracts, or ebracteate; calyx usually irregularly divided; stamens from two to ten; anthers glabrous or rarely pilose. Pistillate flowers in abbreviated or elongated few-flowered spikes from the axils of leaves of the year; styles from three to five, usually five, abbreviated, short and erect, or long, patulous or recurved. Involucre of the fruit open at the mouth, covered with imbricated scales free at the apex; maturation of the fruit annual or biennial; abortive ovules basal, apical, or rarely lateral. Leaves lobed, spinescent or entire. By Engelmann (*Trans. St. Louis Acad.* iii. 381) the North American species of Lepidobalanus are grouped in two subsections: Leucobalanus, the White Oaks, with sessile or subsessile stigmas, annual or rarely biennial maturation of the fruit, basal or rarely lateral abortive ovules, and a glabrous or rarely pubescent inner surface of the pericarp; and Melanobalanus, the Black Oaks, with elongated styles, annual or biennial maturation of the fruit, superior abortive ovules, and a tomentose inner surface of the pericarp. To Lepidobalanus belong, with one exception, all the species of America, Europe, and western Asia, most of the Himalayan species and those of northern China, Manchuria, and northern Japan, or about two thirds of all that are known.

Cyclobalanopsis (Bentham & Hooker, *Gen.* iii. 408. — G. King, *l. c.* 28). Aments of the staminate and pistillate flowers of Lepidobalanus. Scales of the fruiting involucre united in concentric laminæ or zones with crenulate or dentate margins; abortive ovules superior. Leaves usually dentate, rarely lobed or entire. Inhabitants of India, Malaya, southern China, and Japan.

Pasania (Miquel, *Fl. Ned. Ind. Bat.* i. pt. i. 848. — A. de Candolle, *l. c.* 97. — G. King, *l. c.* 37 [Androgyne, A. de Candolle, *l. c.*]). Sterile spikes erect, simple or panicled from the axils of leaves of the year or of the previous year, the flowers in two to five-flowered cymes; stamens usually twice as many as the lobes of the calyx; ovary rudimentary. Pistillate flowers on short pedunculate separate axillary spikes or at the base of the staminate spikes; styles terete, erect and abbreviated or elongated, stigmatic at the apex only; staminodia or abortive stamens as many as and opposite the calyx-lobes. Fruit solitary or in threes, the involucres cup-shaped, saucer-shaped, or discoid, their bracts imbricate, free or united by the bases only; abortive ovules superior. Leaves entire or spinose. Inhabitants of India, Malaya, southern China, and Japan, and of Pacific North America, where a single species occurs.

Cyclobalanus (Endlicher, *l. c.* 28. — A. de Candolle, *l. c.* — G. King, *l. c.* 59 [Gyrolecana, Blume, *Mus. Bot. Lugd. Bat.* i. 299]). Inflorescence and flowers of Pasania. Scales of the involucre united into concentric laminæ or zones with crenulate or dentate margins; abortive ovules superior. Leaves entire. Inhabitants of Malaya and southern China.

Chlamydobalanus (Endlicher, *l. c.* 28. — A. de Candolle, *l. c.* — G. King, *l. c.* 75 [Castaneopsis, Blume, *l. c.* 288. — Encleisocarpon, Miquel, *Ann. Mus. Lugd. Bat.* i. 116]). Spikes erect; flowers and leaves of Pasania. Fruiting involucres ovoid or globose, marked externally with concentric zones, or tuberculate with the thickened points of the scales, closed, or rarely open at the apex only, and enveloping but not attached to the nut except at the base, dehiscent at maturity; abortive ovules superior. Inhabitants of India, Malaya, China, and Japan.

Lithocarpus (Miquel, *l. c.* — A. de Candolle, *Prodr.* xvi. pt. ii. 104. — G. King, *l. c.* 81). Spikes erect; staminate flowers, styles and leaves of Pasania. Fruiting involucres large, thick, and woody,

ovoid or subglobose, concentrically or obliquely zoned, or echinate by the prominent rigid points of the scales, closed or rarely open at the apex by a circumscissile line, enveloping and more or less adnate to the nut, indehiscent; pericarp thick and bony or granulate; abortive ovules superior. Inhabitants of Assam and Malaya.

[4] A. de Candolle, *Prodr.* xvi. pt. ii. 2. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 175; iv. 179.

[5] Née, *Anal. Cienc. Nat.* iii. 276. — Humboldt & Bonpland, *Pl. Æquin.* ii. 24. — Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* ii. 6. — Kunth, *Syn. Pl. Æquin.* i. 353. — Schlechtendal & Chamisso, *Linnæa*, v. 77. — Bentham, *Pl. Hartweg.* 55. — Liebmann, *Oversigt Dansk. Vidensk. Selsk. Forhandl.* 1854, 159. — Martens & Galeotti, *Bull. Acad. Brux.* x. 208. — Seemann, *Bot. Voy. Herald*, 332. — Örsted, *Liebmann Chênes Am. Trop.* — Hemsley, *Bot. Biol. Am. Cent.* iii. 166.

[6] Blume, *Verhand. Batav. Genoot.* ix. 203 (*Javaansche Eiken*); *Bijdr. Fl. Ned. Ind.* 517; *Mus. Bot. Lugd. Bat.* i. 286. — Blume & Fischer, *Fl. Jav.* i. 6. — Korthals, *Verhand. Nat. Geschied. Bot.* 201. — Miquel, *Fl. Ind. Bat.* i. pt. i. 844; *Ann. Mus. Lugd. Bat.* i. 106. — Oudemans, *Verhand. Kon. Akad. Amsterdam*, xi. 1 (*Annotationes Criticæ in Cupuliferas nonnullas Javanicas*).

[7] Blanco, *Fl. Filip.* 725; ed. 3, iv. pt. ii. 207. — Laguna, *Apuntes sobre El Roble de la Flora de Filipinas.*

[8] Loureiro, *Fl. Cochin.* 571. — Abel, *Narrative of a Journey in the Interior of China*, 165, 363. — Carruthers, *Jour. Linn. Soc.* vi. 31. — Hance, *Ann. Sci. Nat.* sér. 4, xviii. 229; *Jour. Bot.* xii. 240. — Bentham, *Fl. Hongk.* 319. — Forbes, *Jour. Bot.* xxii. 80. — Franchet, *Nouv. Arch. Mus.* sér. 2, v. 272 (*Pl. David.* i.).

[9] Thunberg, *Fl. Jap.* 175. — Siebold & Zuccarini, *Abhand. Akad. Münch.* iv. 225. — Franchet & Savatier, *Enum. Pl. Jap.* i. 445.

[10] Fr. Schmidt, *Mém. Acad. Sci. St. Pétersbourg*, xii. No. 2, 171 (*Reisen in Amur-Lande*).

[11] Maximowicz, *Mém. Acad. Sci. St. Pétersbourg*, ix. 241 (*Prim. Fl. Amur.*).

[12] Brandis, *Forest Fl. Brit. Ind.* 477. — Kurz, *Forest Fl. Brit. Burm.* ii. 482. — Hooker f. *Fl. Brit. Ind.* v. 600. — G. King, *Ann. Bot. Gard. Calcutta*, ii. 17 (*Indo-Malayan Species of Quercus and Castanopsis*).

[13] Koch, *Linnæa*, xxii. 317. — Kotschy, *Die Eichen Europa's und des Orients.* — Boissier, *Fl. Orient.* iv. 1163.

[14] Webb, *Iter Hispan.* 10. — Parlatore, *Fl. Ital.* iv. 175. — Willkomm & Lange, *Prodr. Fl. Hispan.* i. 237. — Laguna, *Coniferas y Amentaceas Españolas*, 22; *Fl. Forestal Española*, i. 211. — Borzí, *Compend. Fl. Forestale Italiana*, 147. — Coutinho, *Bol. Soc. Brot.* vi. 47 (*Os Quercus de Portugal*).

[15] A number of Oak-trees are known in North America whose characters, intermediate between those of recognized species associated with them, make it probable that they are natural hybrids. The rarity of these trees, which are always found growing with individuals of the species from which they are supposed to be derived, the variations in the leaves on one tree and often on one branch, and their apparent inability to spread in the forest, support the theory of their hybrid origin. The foliage and fruit of some of the best known and most remarkable of these trees are figured in this volume. The number and variety of such natural hybrids in the United States are probably much greater than is generally supposed; and wherever Oak-trees of several species abound, and the peculiarities of individual trees are carefully studied, forms which can only be accounted for by the hypothesis of natural hybridizing are found. They appear to be most abundant in the middle and southern Atlantic states and in the valley of the Mississippi River, although this may be due to the fact that good observers have happened to live in these regions. In the Pacific forests only one recognized hybrid has yet been discovered, although in southern California individual plants exist which may have been produced by the crossing of *Quercus Douglasii* with *Quercus dumosa.* Too little, however, is known of the innumerable forms which plants of these species assume to make possible any conclusions on this subject. American hybrid Oaks appear to be all derived from the crossing of species of the same section of the genus Lepidobalanus; and there are no indications that species with annual-maturing fruit cross with those whose acorns ripen in the second year (Engelmann, *Trans. St. Louis Acad.* iii. 397).

In addition to the supposed hybrids of *Quercus Cerris* which originated in England among cultivated trees, several hybrids between closely related species, like *Quercus Robur* and *Quercus Lusitanica* with deciduous leaves, and between *Quercus Ilex* and *Quercus Suber* with persistent leaves, have been noticed in southern Europe, especially in Spain and Portugal, where the genus is an important commercial element of the forest, and in recent years has been carefully studied. (See Brotero, *Fl. Lusitan.* ii. 31. — Saporta, *Compt. Rend.* lxxxiv. 245. — Barros Gomes, *Condições Forestaes de Portugal*, 60. — Laguna, *Rev. de Montes*, 1881, 477 (*Un Mesto Italiano y Varios Mestos Españoles*); *Fl. Forestal Española*, i. 272. — Borzí, *l. c.* 149. — Coutinho, *l. c.* 104. — Debeaux, *Fl. de la Kabylie du Djurdjura*, 333.)

[16] In the deciduous-leaved forests of eastern America, which, except in the extreme north, are largely composed of different Oak-trees, their numbers are increasing and they are gradually usurping the places formerly occupied by other trees. The vitality of the Oak and its ability to produce year after year shoots from the stump enable it to survive the effects of fire, which usually destroys other trees, but only checks and does not kill the Oak. Its seeds germinating under the shade of the coniferous forest produce plants which, kept alive by a few small leaves and developing powerful roots, spring up into vigorous growth as soon as the forest that has dwarfed them is cut away, and take possession of the ground to the exclusion of the species that covered it before. The Oak thus replaces the Pine, and continually as the forests of eastern America are burnt extends its sway. Forests of Oak, too, have recently spread over regions in the basin of the Mississippi where prairies existed before the white man checked the Indian fires which year after year had swept them bare of trees. The Oak forests of the middle and southern states, although increasing in area, are deteriorating, however, in composition, the White Oaks being gradually overpowered by the less valuable Black Oaks, whose bitter acorns are left to germinate by the hogs which pasture in the forest and devour the sweet acorns of the White Oaks.

[17] Saporta, *Origine Paléontologique des Arbres*, 159. — Zittel, *Handb. Palæontolog.* ii. 433.

[18] Lesquereux, *Rep. U. S. Geolog. Surv.* vii. 147; viii. 224 (*Contrib. Fossil Fl. W. Territories*, ii., iii.); *Mem. Mus. Comp. Zoöl.* vi. pt. ii. 4 (*Fossil Plants of the Auriferous Gravel Deposits of the Sierra Nevada*).

[19] Of the eighty or ninety species of Quercus that have been described in books devoted to the floras of Mexico and tropical America, little is known regarding their economic properties and value, and comparatively little of their specific characters and geographical distribution. Little is known economically, too, of the noble Oaks of Malaya, or of those of China, where at least thirty species exist. Some of these are large and valuable trees, supplying timber for construction, and tanning material, or substances employed in the Chinese Materia Medica. (For an early account of the Oak-trees of China, see *Mémoires sur les Chinois*, iii. 484.)

[20] Linnæus, *Spec.* 996 (1753). — A. de Candolle, *Prodr.* xvi. pt. ii. 4.

Quercus Robur, which once formed large forests in central and northern Europe, is generally distributed from the shores of the Atlantic Ocean to Asia Minor and the trans-Caucasian provinces of western Asia, and from those of the Mediterranean to Scandinavia and northern Russia.

Two races or subspecies (*pedunculata* and *sessiliflora*) with many natural and accidental forms are distinguished.

Quercus pedunculata (Ehrhart, *Beitr.* v. 161) (*Quercus Robur pedunculata*, Smith, *English Bot.* xix. t. 1342. — Reichenbach, *Icon. Fl. German.* xii. 8, t. 648. — Hartig, *Forst. Culturpfl. Deutsch.* 109, t. 12. — Kotschy, *Die Eichen Europa's und des Orients*, t. 27. — Boissier, *Fl. Orient.* iv. 1163) is distinguished by its ovoid leaf-buds, short petioles, and elongated fruit-stalks. Usually found on alluvial plains, it often forms nearly pure forests in the valleys of central Europe.

Quercus sessiliflora (Salisbury, *Prodr.* 392. — Smith, *l. c.* t. 1345. — Reichenbach, *l. c.* 7, t. 644. — Hartig, *l. c.* t. 11. — Boissier, *l. c.* 1164. — Hempel & Wilhelm, *Bäume und Sträucher*, t. 22, 23) is distinguished by its ovoid lanceolate leaf-buds, longer petioles, and short-stalked or sessile fruit. Widely distributed through Europe and western Asia, this form is usually accompanied by the Beech and the Hornbeam on broken, hilly, or mountainous ground.

[21] Lamarck, *Dict.* i. 719 (1783). — Brotero, *Fl. Lusitan.* ii. 33. — Webb, *Iter Hispan.* 11. — Boissier, *Voyage*, ii. 575; *Fl. Orient.* iv. 1166. — A. de Candolle, *Prodr. l. c.* 17. — Willkomm & Lange, *Prodr. Fl. Hispan.* i. 240. — Laguna, *Fl. Forestal Española*, i. 235, t. 32, 33, f. 4, 5. — Coutinho, *Bol. Soc. Brot.* vi. 66 (*Os Quercus de Portugal*).

Quercus Lusitanica is widely distributed in numerous arborescent and shrubby forms through the countries bordering the Mediterranean. Of the three subspecies in which the varieties of this polymorphous species are grouped by A. de Candolle, the most important as a timber-tree is the Algerian Zéen (subspecies *Bætica* *a Mirbeckii* [*Quercus Mirbeckii*, Durieu, *Duchartre Rev. Bot.* ii. 426 [1846] — Trabut, *Rév. Gen. Bot.* iv. 1, t. 1–3]). This noble tree, which sometimes grows to the height of one hundred feet with a trunk three feet in diameter, is a native of southern Spain, where it is rare and local, and of Algeria and Tunis, where it grows in the humid littoral region and on the high mountains of the interior, which it ascends to high elevations. Requiring a comparatively moist soil, it selects deep ravines opening toward the north and rarely appears on southern slopes at elevations below twenty-five hundred feet above the level of the sea, growing often in dense forests with scattered Chestnuts, Cork Oaks, and Cedars. The wood of the Algerian Zéen, which is one of the largest and most valuable trees of northern Africa, is heavy, hard, strong, close-grained, and very durable, although difficult to season. It is used in construction and for railroad ties and makes excellent fuel and charcoal, while the bark is valued for tanning leather. (See Renou, *Annales Forestières*, i. 422 (*Fôrets de l'Algérie*). — Legrand, *Nouv. Ann. de la Marine et des Colonies*, 1854 [*Mém. sur les Richesses Forestières de l'Algérie*, 15, 49]. — Mathieu, *Flore Forestière*, éd. 2, 250. — Cosson, *Annuaire de la Société Impérial de l'Acclimatation*, 1863, 298. — Livet, *La Tunisie ses Eaux et ses Fôrets*, 23. — Lamey, *Fôrets de la Tunisie*, 97.)

Exceedingly umbrageous, the Zéen is recommended as an ornamental tree for temperate regions with dry climates, and, as it opens its buds in the winter or very early spring, it has been suggested as a food-plant, in southern Europe, for the Oak-feeding silk-worms of eastern Asia, which hatch before the indigenous Oak-trees develop their leaves (Naudin, *Manuel de l'Acclimateur*, 453).

[22] A. de Candolle, *l. c.* 41 (1864). — Royle, *Ill.* t. 84, f. 2. — Brandis, *Forest Fl. Brit. Ind.* 482. — Hooker f. *Fl. Brit. Ind.* v. 602. — G. King, *Ann. Bot. Gard. Calcutta*, 23, t. 15, f. 4–7 (*Indo-Malayan Species of Quercus and Castanopsis*).

This is a gregarious subevergreen tree distributed over the northwestern Himalayas from Kumaon to Cashmere, sometimes ascending to elevations of ten thousand feet above the sea-level, and often forming nearly pure forests of considerable extent. The wood is dark-colored, hard, heavy, and very durable, and is largely used in construction and for agricultural implements and axe-handles. The leaves are valued as fodder for sheep and goats (Gamble, *Man. Indian Timbers*, 383).

[23] A. de Candolle, *l. c.* 14 (1864). — Miquel, *Ann. Mus. Lugd. Bat.* i. 104. — Hooker f. *l. c.* 602. — G. King, *l. c.* 24, t. 18.

? Quercus aliena, Blume, *Mus. Bot. Lugd. Bat.* i. 298 (1850). — Miquel, *l. c.* — A. de Candolle, *l. c.* 14. — Hance, *Jour. Bot.* xiii. 361. — Franchet & Savatier, *Enum. Pl. Jap.* i. 445. — G. King, *l. c.* 25.

Quercus Griffithii is a large deciduous-leaved tree which produces wood that resembles that of the European *Quercus Robur*, and is more valuable than that of the other Oak-trees of the eastern Himalayas (Gamble, *l. c.* 381).

[24] Ledebour, *Fl. Ross.* iii. pt. ii. 589 (1849.) — Turczaninow, *Fl. Baicalensi-Dahurica*, ii. pt. i. 136. — Ruprecht & Maximowicz, *Bull. Phys. Math. Acad. Sci. St. Pétersbourg*, xv. 137 (*Mél. Biol.* ii. 432). — Ruprecht & Maack, *Bull. Phys. Math. Acad. Sci. St. Pétersbourg*, xv. 373. — Maximowicz, *Mém. Acad. Sci. St. Pétersbourg*, ix. 241. (*Prim. Fl. Amur.*). — Regel, *Mém. Acad. Sci. St. Pétersbourg*, iv. 130 (*Tent. Fl. Ussur.*). — A. de Candolle, *l. c.* — Fr. Schmidt, *Mém. Acad. Sci. St. Pétersbourg*, xii. No. 2, 171 (*Reisen in Amur-Lande*). — Herder, *Act. Hort. Petrop.* xi. 365 (*Pl. Radd.*) — Korshinsky, *Act. Hort. Petrop.* xii. 388 (*Pl. Amur.*).

Quercus Robur, Pallas, *Fl. Ross.* ii. 3 (in part) (1788).

Quercus sessiliflora, var. *Mongolica*, Franchet, *Nouv. Arch. Mus.* sér. 2, v. 273 (*Pl. David.* i.) (1884).

This tree, the eastern Asiatic representative of *Quercus Robur*, is the common Oak of eastern Siberia, and of Manchuria where it forms vast forests in the valley of the Amour River and in northern China. It is common on Saghalin and in slightly modified forms (*Quercus crispula*, Blume [*l. c.*], and *Quercus grosseserrata*, Blume [*l. c.* 296]) constitutes a large proportion of the deciduous-leaved forests of Yezo, where it grows to a large size and produces timber of first-rate quality. By Franchet the Mongolian Oak has been considered a geographical variety of the European *Quercus Robur*. G. King (*l. c.*) has suggested its specific identity with the Indian *Quercus Griffithii* on one hand, and with the two White Oaks of Yezo on the other; and this view, in so far as it concerns *Quercus grosseserrata*, is substantiated by the observations of Miyabe (*Mem. Bost. Soc. Nat. Hist.* iv. 259 [*Fl. Kurile Islands*]).

[25] Gerber, *Archiv. der Pharm.* xxxviii. 272 (*Analyse der Eichenrinde*); ser. 2, xxiv. 167 (*Ueber das Quercin oder den Krystallinischen Stoff der Eichenrinde*). — Eckert, *Vierteljahresschrift für Prak. Pharm.* xiii. 494 (*Untersuchung über die Bestandtheile der Eichenrinde*). — Wiesner, *Die Rohstoffe des Pflanzenreiche*, 480. — Höhnel, *Die Gerberinden*, 59. — Procter, *Text Book of Tanning*, 38. — Henry, *Ann. Sci. Agronomique Française et Etrangère*, i. 358 (*Répartition du Tanin dans les Diverses Régions du Bois de Chêne*). — Trimble, *The Tannins*, ii. 11.

[26] In North America no attempts have been made to raise Oak-woods for the sake of tan-bark, and trees growing spontaneously in the forests have been relied upon to furnish the oak-bark used in the United States in the preparation of leather; but in France, Germany, Austria, and other European countries the production of oak-bark from plantations created for the purpose is an important

industry and has been practiced for centuries. The bark is believed to be most rich in the astringent principle when harvested in May and June, and a warm climate or a southern exposure is considered most favorable to its production. The bark is usually gathered from saplings from twenty to thirty years old, or before they have developed the corky layer of outer bark, which is useless for tanning purposes. In harvesting the bark the trees are cut, the plantations or coppice woods renewing themselves several times by the vigorous shoots which spring from the stumps of all Oak-trees. (See Perrault, *De l'Écorçage du Chêne, de la Production et de la Consommation des Écorces à Tan en France.* — Neubrand, *Die Gerbrinde.*)

[27] Linnæus, *Spec.* 997 (1753). — *Nouveau Duhamel,* vii. 182, t. 57. — Watson, *Dendr. Brit.* ii. 92, t. 92. — Reichenbach, *Icon. Fl. German.* xii. 9, t. 650. — Hartig, *Forst. Culturpfl. Deutsch.* 578, t. 14. — A. de Candolle, *Prodr.* xvi. pt. ii. 41. — Parlatore, *Fl. Ital.* iv. 185. — Boissier, *Fl. Orient.* iv. 1170. — Willkomm & Lange, *Prodr. Fl. Hispan.* i. 241. — Laguna, *Fl. Forestal Española,* 268.

Quercus Esculus, Linnæus, *Mant.* 496 (1771).

Quercus Ægilops, Scopoli, *Fl. Carn.* ed. 2, ii. 241 (not Linnæus) (1772).

Quercus crinita, Lamarck, *Dict.* i. 718 (1783). — Olivier, *Voyages,* Atlas, p. vi.

Quercus Tournefortii, Willdenow, *Sp.* iv. pt. i. 453 (1805).

Quercus Austriaca, Willdenow, *l. c.* 454 (1805). — Kotschy, *Die Eichen Europa's und des Orients,* t. 20.

Quercus Cerris is the type of a peculiar group of Lepidobalanus (subgenus Cerris, Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 66) with linear styles subulate at the apex, inferior abortive ovules, biennial maturation, and mostly persistent leaves, which is chiefly confined to the Mediterranean basin and western Asia, but also, with a few species, inhabits southern India, China and Japan, and tropical America. *Quercus Cerris* is a tree of rapid growth and noble size, abounding in the forests of northern Syria, southern Russia, the Turkish peninsula, and the country south of the Black Sea, and ranging westward through southern Europe and northward in Europe to Hungary and the Department of the Doubs in France. In the countries of southeastern Europe the wood, which is hard, heavy, and strong, is used in construction and shipbuilding (Mathieu, *Flore Forestière,* éd. 2, 251). The bark is considered more valuable than that of *Quercus Robur* for tanning leather.

Quercus Cerris is esteemed as an ornamental tree in western and central Europe, and is occasionally planted in the gardens of the United States, where it is hardy as far north as eastern Massachusetts. Several accidental varieties or hybrids have appeared among cultivated plants. The most interesting of these, the Lucombe Oak, is supposed to be a hybrid with *Quercus Suber.* It was raised by a nurseryman of Exeter in England named Lucombe from a seed of *Quercus Cerris* gathered from a tree standing near a specimen of *Quercus Suber,* and planted about 1762. The original tree was cut when about twenty years old and during Mr. Lucombe's lifetime, in order, it is said, to furnish material for his coffin ; it had been multiplied, however, by grafts, and specimens of this evergreen or subevergreen Oak may still be seen in English parks and pleasure-grounds (Zephaniah Holwel, *Phil. Trans.* lxii. 128. — Evelyn, *Silva,* ed. Hunter, i. 72. — Loudon, *Arb. Brit.* iii. 1851, f. 1712–1714).

The Fulham Oak (*Quercus Cerris denticulata,* Watson, *l. c.* 93, t. 93. — *Quercus Cerris Fulhamensis,* Loudon, *l. c.* 1850, f. 1710, t.), a variety of *Quercus Cerris,* or perhaps a hybrid with some other species, originated in the Fulham Nurseries in Exeter about a century ago ; it is a large tree with broad, subevergreen coarsely dentate leaves. Varieties of *Quercus Cerris* with pinnatifid or sinuate-toothed leaves, with variegated foliage, and with pendulous branches, are also cultivated (Loudon, *l. c.* 1847. — A. de Candolle, *l. c.* — Dippel, *Handb. Laubholzk.* ii. 95).

[28] Linnæus, *l. c.* 995 (1753). — Brotero, *Fl. Lusitan.* ii. 33. — *Nouveau Duhamel,* vii. 156, t. 43, 44, f. 2. — Watson, *l. c.* ii. 90, t. 90. — Reichenbach, *l. c.* 7, t. 642. — Kotschy, *l. c.* t. 38. — A. de Candolle, *l. c.* 38. — Parlatore, *l. c.* 197. — Willkomm & Lange, *l. c.* 243. — Boissier, *l. c.* 1167. — Laguna, *l. c.* 252, t. 35, 36. — Coutinho, *Bol. Soc. Brot.* vi. 94 (*Os Quercus de Portugal*). — Hooker f. *Fl. Brit. Ind.* v. 602. — G. King, *Ann. Bot. Gard. Calcutta,* ii. 24, t. 17 (*Indo-Malayan Species of Quercus and Castanopsis*).

Quercus Gramuntia, Linnæus, *l. c.* (1753). — Loudon, *l. c.* 1906, f. 1787, 1788.

Quercus calicina, Poiret, *Lam. Dict.* Suppl. ii. 216 (1811).

Quercus expansa, Poiret, *l. c.* (1811).

Quercus Baloot, Griffith, *Itinerary Notes,* ii. 328 (1848). — A. de Candolle, *l. c.*

Quercus Balout, Boissier, *l. c.* 1168 (1879).

Quercus Ilex is the type of Örsted's (*l. c.* 61) section Ilex of Lepidobalanus, distinguished by rigid coriaceous, entire, or spinose-dentate, subevergreen leaves, and confined to the Mediterranean basin, Asia Minor, Afghanistan, and the northwestern Himalayas, China, and Japan, Mexico, Central America, and the southeastern and southwestern United States. *Quercus Ilex* is distributed through the countries bordering the Mediterranean, from Spain and Morocco to the Syrian coast, and reappears in Afghanistan and on the eastern Himalayas, where it ascends to elevations of from three thousand to eight thousand five hundred feet above the sea-level. In some parts of Spain, southern France, Corsica, Siberia, and Algeria, great natural forests of the Ilex exist, and in southern France it is cultivated in coppice to supply tanners with bark. The wood is close-grained, hard, and heavy, and dark reddish-brown or nearly black ; it makes excellent fuel and charcoal ; and in India it is used for plows and other agricultural implements, and for the handles of small tools (Brandis, *Forest Fl. Brit. Ind.* 481).

In southern Europe the comestible truffles (*Tuber brumale,* Vittadini, and *Tuber melanosporum,* Vittadini) are found growing near the roots of the Ilex and of several other Oak-trees, or can be produced in the course of a few years by establishing plantations of it in calcareous soil (Bosredon, *Manuel du Trufficulteur*).

From the time of the Romans the Ilex has been valued as an ornamental plant, and to the deep shade of its leafy crown many gardens of Italy still owe their greatest charm. Introduced into England in 1581, it is hardy in the neighborhood of London, where it ripens its fruit in favorable seasons. Several accidental varieties have appeared and are sometimes found in cultivation (Loudon, *l. c.* 1888).

Of all acorns, those of a variety of the Ilex are most valued as human food. It is : —

Quercus Ilex, γ *Ballota,* A. de Candolle, *l. c.* 39 (1864). — Coutinho, *l. c.* 97.

Quercus rotundifolia, Lamarck, *l. c.* (1783) 723 (excl. syn. Gramuntia) (1781). — Brotero, *l. c.* 33.

Quercus Ballota, Desfontaines, *Mém. Acad. Sci. Paris,* 1790, 394, t. 6 ; *Fl. Atlant.* ii. 350. — Webb, *Iter Hispan.* 14. — Boissier, *Voyage,* ii. 578. — Loudon, *l. c.* 882, f. 1612, 1613. — Willkomm & Lange, *l. c.* 244.

In some parts of southern France, Spain, and Algeria, where this form is common, the acorns are an important article of food for the lower classes, who prefer them to chestnuts and eat them roasted or boiled (Colmeiro y Boutelou, *Examen de las Encinas y demas Arboles de la Peninsula que producen Bellotas,* 10. — Mathieu, *l. c.* 257).

[29] Bosc, *Jour. Hist. Nat. Paris,* ii. 155, t. 22, f. 3 (1792). — Bois-

sier, *Voyage*, ii. 575. — Kotschy, *Die Eichen Europa's und des Orients*, t. 22. — Willkomm & Lange, *Prodr. Fl. Hispan.* i. 239. — Hooker f. *Trans. Linn. Soc.* xxiii. 386. — A. de Candolle, *Prodr.* xvi. pt. ii. 12. — Laguna, *Fl. Florestal Española*, i. 231, t. 31. — Coutinho, *Bol. Soc. Brot.* vi. 64 (*Os Quercus de Portugal*).

Quercus nigra, Thoré, *Chlor. Landes*, 381 (not Linnæus) (1803).

Quercus pubescens, Brotero, *Fl. Lusitan.* ii. 31 (1804).

Quercus Pyrenaica, Willdenow, *Spec.* iv. pt. i. 451 (1805). — *Nouveau Duhamel*, vii. 178, t. 56.

Quercus Tauzin, Persoon, *Syn.* ii. 571 (1807).

Quercus stolonifera, Lapeyrouse, *Hist. Pl. Pyr.* 582 (1813).

The Tauzin is a small, deciduous-leaved, bushy, usually contorted tree, and is common in southwestern France and the Iberian peninsula and in some parts of Syria. On sandy soil in southwestern Europe it forms vigorous coppice-woods and supplies excellent material for tanning. The wood is hard and strong, and is esteemed as fuel and for charcoal (Mathieu, *Fl. Forestière*, éd. 2, 247).

[30] Linnæus, *Spec.* 996 (1753). — Olivier, *Voyages*, Atlas, p. vi. t. 13. — Tchihatcheff, *Asie Min. Bot.* ii. 470, t. 41, 42. — Boissier, *Fl. Orient.* iv. 1171.

Quercus Ithaburensis, Decaisne, *Ann. Sci. Nat.* sér. 2, iv. 348 (1835). — Kotschy, *l. c.* t. 12.

Quercus Trojana, Jaubert & Spach, *Ill. Pl. Orient.* i. t. 57 (1842).

Quercus Pryami, Kotschy, *l. c.* t. 3 (1858).

Quercus Ungeri, Kotschy, *l. c.* t. 13 (1858).

Quercus macrolepis, Kotschy, *l. c.* t. 16 (1858).

Quercus Vallonea, A. de Candolle, *l. c.* 45 (not Kotschy) (1864).

An inhabitant of Syria, Anatolia, and Greece, the Valonia Oak is a gregarious species, growing in Syria as a low tree with a stout gnarled trunk, and in one of its forms (β *macrolepis*, Boissier, *l. c.*) forming great forests in some parts of Greece, especially on the lower slopes of Taygetos and in Crete. The wood is hard and tough, and is valued for fuel. The nuts, which are large and very variable in shape, are sold in great quantities in the bazaars and are eaten raw or cooked (Hooker f. *l. c.* 384, t. 88). The cups are used for tanning, and are exported under the name of valonia from Asia Minor and Greece to Europe and the United States. They contain from twenty-five to thirty-five per cent. of tannin, and, imparting a light color and greater weight and firmness to leather than the tannin of oak-bark, they are especially valued for tanning sole leather. The fruit of the Valonia Oak is beaten from the branches as soon as it ripens in July and August, and is allowed to lie on the ground under the trees for some time to dry. It is then collected and sent to centres of shipment, where it is placed in piles five or six feet deep in well-ventilated storehouses and left to heat for several weeks. During this process the nuts separate from the cups and are fed to hogs; and the cups are sorted according to their quality and are then ready for shipment. Smyrna is the principal market, although large quantities are also exported from different Greek ports (Spons, *Encyclopædia of the Industrial Arts, Manufactures, and Raw Commercial Products*, ii. 1226, 1992).

A saccharine substance which exudes from the punctures of a coccus in the branches of *Quercus Vallonea* and of *Quercus Persica* (Jaubert & Spach, *l. c.* i. t. 55 (1842). — Kotschy, *l. c.* t. 28) is gathered by some of the wandering tribes of Kurdistan and used to sweeten food. The exudation hardens in small grains, and is shaken in early morning from the trees on to sheets spread out on the ground or is obtained by dipping the branches into hot water and evaporating the solution to the consistency of syrup (Flückiger & Hanbury, *Pharmacographia*, 372).

[31] "These Akornes also they drie, and in case of want of Corne, by much boyling they make a good dish of them: yea sometimes in plentie of Corne doe they eate these Acornes for a novelty." (Roger Williams, *A Key into the Language of America* [*R. I. Hist. Soc. Coll.* i. 90]).

"And out of the white Oak Acorns, (which is the Acorn Bears delight to feed upon): The Natives draw an Oyl, taking the rottenest Maple Wood, which being burnt to ashes, they make a strong Lye therewith, wherein they boyl their white Oak-Acorns until the Oyl swim on the top in great quantity; this they fleet off, and put into bladders to annoint their naked Limbs, which corrobarates them exceedingly; they eat it likewise with their Meat, it is an excellent clear and sweet Oyl." (Josselyn, *New England Rarities*, 48.)

[32] Newberry, *Popular Science Monthly*, xxxii. 37 (*Food and Fibre Plants of the North American Indians*).

[33] Linnæus, *Spec. l. c.* 995 (1753). — Brotero, *l. c.* ii. 34. — *Nouveau Duhamel*, vii. 159, t. 45. — Watson, *Dendr. Brit.* ii. 89, t. 89. — Boissier, *Voyage*, ii. 577. — Reichenbach, *Icon. Fl. German.* xii. 7, t. 641. — A. de Candolle, *l. c.* 40. — Parlatore, *Fl. Ital.* iv. 192. — Willkomm & Lange, *l. c.* i. 243. — Laguna, *l. c.* 243, t. 34. — Coutinho, *l. c.* 82.

Quercus Ilex suberosa, Visiani, *Fl. Dal.* i. 208 (1842).

The Cork Oak inhabits southern France, Catalonia, Andalusia, and Estremadura in Spain, Portugal, Tuscany, Sardinia, and Sicily, the Istrian Peninsula and Greece, forming extensive forests either alone or mixed with the Ilex and the Maritime Pine; it inhabits also the coast region of northern Africa from western Morocco to Tunis, where vast Cork Oak forests still exist. While adapting itself to the climatic conditions of both plains and mountains, it appears to be most vigorous on low hills, and in Europe rarely ascends more than two thousand feet above the sea-level, although on some of the mountain ranges of Algeria the Cork Oak grows freely up to elevations of four thousand feet. Although attaining its largest size in deep rather moist loam underlaid with granite or porphyry, it flourishes in all soils except those composed of limestone or heavy clay, and reaches good dimensions in sand if its roots are able to reach a loose subsoil. It is a long-lived tree, usually not more than thirty or thirty-five feet in height, with a short trunk, sometimes growing, however, to twice this height under exceptionally favorable conditions. The roots are large and penetrate deep into the soil, and the vitality of the tree is so great that when it is cut, or destroyed by fire, it is able to continue producing shoots from the stump to an advanced age.

The wood of *Quercus Suber* is hard, close-grained, difficult to split or work, and rather heavier than that of *Quercus Robur*; it is sometimes used for rude agricultural implements and the handles of tools, and makes excellent fuel and charcoal. The chief value of the Cork Oak, however, is in the outer layer of the bark, a homogeneous spongy, elastic, and compressible mass often several inches in thickness, which can be removed without affecting the health of the tree and continues to renew itself as long as the tree remains vigorous. (For accounts of the structure and development of the bark of the Cork Oak, see Dutrochet, *Compt. Rend. Acad. Sci.* iv. 48. — Mohl, *Flora*, xx. pt. ii. 673. — C. de Candolle, *Mém. Soc. Phys. et Hist. Nat. Genève*, xvi. 1. — Wiesner, *Die Rohstoffe des Pflanzenreiches*, 474. — Sanio, *Pringsheim's Jahrb. Bot.* ii. 39.)

Although well known to the Greeks and Romans, who used it to float their nets and for various domestic purposes, cork did not become an important article of commerce until the seventeenth century, when glass bottles came into general use. The systematic care of forests of Cork Oak, with the regular harvesting of their crops of bark, was instituted in northeastern Spain in 1760 (Artigas y Teixidor, *Alcornocales y la Industria Taponera*, 23); and in

Gerona, which saw the beginning of this industry, the best managed forests of Cork Oak are still to be found. From Spain it gradually spread into France and Italy, and much later into Portugal and Algeria, but in recent years Portugal has taken the lead in the production of cork, her forests now yielding a larger quantity than those of all other countries combined. Cork is principally obtained from the natural forests, few artificial plantations having yet been established for this purpose. The management consists in protecting the forest from fires, which, in Africa especially, have destroyed great numbers of Cork-trees, and in dividing it into sections corresponding in number to the number of years required by a tree to produce a crop of bark of marketable thickness, so that a regular annual product may be insured by working each year the trees in one of the sections.

Cork is first removed from trees with trunks six or eight inches in diameter, or from twenty-five to thirty years of age. The first crop is called virgin cork, and is of comparatively little value. Subsequently, the operation of harvesting the cork may be repeated once in every ten or twelve years for about a century, or as long as the tree retains its vigor. It can be most easily removed in early summer during the most active period of growth. Sometimes the cork is taken from the whole trunk at once, and sometimes in two or three annual sections. In either case, rings are cut with a hatchet through the outer layer of bark at the top and the bottom of the portion to be removed, and are connected by a horizontal incision or by two or three incisions if the trunk is so large that the cork cannot be removed in a single piece. Beginning at the upper ring, the workman then gradually loosens the corky layer with the flattened, slightly curved handle of his hatchet, and separates it from the inner layer of bark. This is the phellogen, or cork cambium, called mother cork, and upon its integrity depends all the future value of the Cork-tree ; the operation, therefore, of removing the cork should be intrusted to careful and experienced men, as a cut through the living tissue or a bruise made in it with the handle of the hatchet might injure the life of the tree or make a wound which would prevent the development of another crop of bark.

The inner or mother bark of the Cork Oak is rich in tannin, and as it can only be obtained by destroying the tree, whole forests of Cork Oaks have been sacrificed during the last fifty years in Italy and Algeria to supply the demand for tanning material.

Introduced several years ago into California, the Cork Oak flourishes in the southern part of the state and may in time become an important factor in its commercial prosperity, as it may in British India, where it has also been successfully introduced. (For accounts of the Cork Oak, its cultivation, products, etc., see Duchesne, *Guide de la Culture des Bois*, 171, t. — Jaubert de Passa, *Annales Forestières*, i. 175. — Eymard, *Annales Forestières*, iii. 245 (*De la Culture du Chêne-Liège*). — Lambert, *Exploitation des Fôrets de Chêne-Liège et des Bois d'Olivier en Algérie.* — Mathieu, *Flore Forestière*, éd. 2, 257. — Balaguer y Primo, *Industria Corchera.* — Artigas y Teixidor, *El Alcornoque y la Industria Taponera.* — Hope, *Essai sur l'Exploitation du Chêne-Liège en Algérie.* — Lamey, *Le Chêne-Liège en Algérie ; Notice sur les Fôrets de la Tunisie*, 93 ; *Le Chêne-Liège, sa Culture et son Exploitation.* — David, *Le Chêne-Liège, sa Culture et sa Maladie dans le Var.* — Jordana y Morera, *Notas sobre los Alcornocales, la Industria Corchera de la Argelia.* — De la Grye, *Revue des Eaux et Fôrets*, xxiv. 549. — Capgrand-Mothes, *Revue des Eaux et Fôrets*, xxv. 80. — Gaffigny, *Le Liège et ses Applications.* — Sousa Pimentel, *Pinhaes, Soutos e Montados.* — Combe, *Région du Chêne-Liège en Europe et dans l'Afrique Septentrionale ; Les Fôrets de l'Algérie.* —Jackson, *Commercial Botany of the Nineteenth Century*, 159.)

[34] Gay, *Ann. Sci. Nat.* sér. 4, vi. 243 (1856). — A. de Candolle, *Prodr.* xvi. pt. ii. 44. — Willkomm & Lange, *Prodr. Fl. Hispan.* i. 242. — Laguna, *Fl. Florestal Española*, i. 271.

This tree, which is distinguished by the biennial maturation of the fruit from *Quercus Suber*, with which it was long confounded, is an inhabitant of southwestern France, its principal station being in the Landes of Gascony between the Garonne and the Pyrenees, where it is found growing in company with the Maritime Pine in sheltered situations on the sandy coast plain ; in Spain it inhabits the shores of the Bay of Biscay and Estremadura ; and in Portugal, while often scattered through the forests of *Quercus Suber*, it is said to become the prevailing species in the forests of evergreen Oaks in the immediate neighborhood of the coast. Producing cork as freely as *Quercus Suber*, it is not economically distinguished from it ; nor do Portuguese botanists now generally consider it specifically distinct from that species, which, growing nearly continuously and often flowering more than once during the year in the mild climate of the Atlantic coast region, often produces fruit on branches which appear to belong to the previous but are really of the current year. (See Barros-Gomes, *Condições Florestaes de Portugal*, 56. — Coutinho, *Bol. Soc. Brot.* vi. 88 (*Os Quercus de Portugal*). — Faxon, *Garden and Forest*, viii. 52.)

Quercus occidentalis was planted as an ornamental tree by Bernard de Jussieu in the park of the Petit Trianon at Versailles in 1756, and, being hardier than *Quercus Suber*, it is now more often seen in the gardens and parks of western France (Mathieu, *l. c.* 264. — Lamey, *Le Chêne-Liège, sa Culture et son Exploitation*, 7).

[35] The Oak-galls, or nut-galls of commerce, are produced by *Cynips Gallæ tinctoriæ*, Olivier, on the branches of a variety of *Quercus Lusitanica*. This is : —

Quercus Lusitanica, α *infectoria*, A. de Candolle, *l. c.* 18 (1864).

Quercus infectoria, Olivier, *Voyages*, i. 253, t. 14, 15 (1801). — *Nouveau Duhamel*, vii. 162, t. 49, f. 1. — Hayne, *Arzn.* xii. t. 45. — Carson, *Med. Bot.* ii. 40, t. 85. — Hooker f. *Trans. Linn. Soc.* xxiii. 383 (excl. syn.).

Quercus Lusitanica, α *genuina*, Boissier, *Fl. Orient.* iv. 1167 (1879).

It is a small bushy tree or shrub distributed from the Island of Cyprus to the western borders of Persia, and very abundant on the mountain-slopes of Syria and Asia Minor. The female insect punctures the young and tender shoots of the tree with her ovipositor and deposits her eggs. This produces an abnormal affluence of the juices of the plant to the shoot and the growth of an excrescence or gall, which attains its full size at the end of five or six months, when the larvæ are hatched and, transformed into winged insects, bore an exit from the gall. The best galls are those which are gathered while the insect is in the larval state ; these are dark olive-green, although after the escape of the insect they lose their color and become light yellow-green. Commercially, the galls in these conditions are distinguished as blue or green, and as white. Aleppo, which has given its name to the oak-galls of commerce, was once the chief centre of their collection and exportation ; but in recent years the Aleppo product has greatly decreased in importance, and oak-galls are now mostly gathered on the Syrian coast and in Melelem, Cassaba, and Magnesia. They are also collected on the Kurdistan Mountains, and are exported in considerable quantities from Bussora, Bagdad, and Bashire. Oak-galls, which contain from sixty to seventy per cent. of tannic or gallotannic acid, were known to the Greeks and Romans, and for tanning and dyeing and the making of ink have been used from ancient times. Once employed in medicine, they are no longer used in this manner except in external applications (Flückiger & Hanbury, *Pharmacographia*, 536. — Guibourt, *Hist. Drog.* ed. 7, ii. 289, f. 429, 430. — Spons, *Encyclopædia of the Industrial Arts, Manufactures, and Raw Commercial Products*, ii. 1983. — *U. S. Dispens.* ed. 16, 717).

[36] Linnæus, *Spec.* 995 (1753). — Brotero, *Fl. Lusitan.* ii. 32. — *Nouveau Duhamel*, vii. 160, t. 46. — Webb, *Iter Hispan.* 15. — A. de Candolle, *Prodr.* xvi. pt. ii. 52. — Willkomm & Lange, *Prodr. Fl. Hispan.* i. 245. — Laguna, *Fl. Forestal Española*, i. 263, t. 37. — Coutinho, *Bol. Soc. Brot.* vi. 100 (*Os Quercus de Portugal*).

This very variable bushy tree is distributed from Portugal and Morocco to Syria and Asia Minor. The most interesting, perhaps, of its numerous varieties that have been described is : —

Quercus coccifera, ζ *Palestina*, Boissier, *Fl. Orient.* iv. 1170 (1879).

Quercus Palestina, Kotschy, *Die Eichen Europa's und des Orients*, t. 19 (1858).

Quercus Calliprinos, λ *arcuata*, A. de Candolle, *l. c.* 56 (1864).

Quercus pseudo-coccifera, Hooker f. *Trans. Linn. Soc.* xxiii. 381, t. 36, 37 (excl. syn.) (not Desfontaines) (1861).

This is the most abundant tree of Syria, covering the rocky hills of Palestine with a shrubby growth and occasionally growing to a large size ; and to this variety belongs the famous Oak of Mamre, known as David's Oak, which is popularly supposed to mark the spot where grew the Oak or Lentisk-tree under which the patriarch pitched his tent, and which is revered by Jews, Mohammedans, and Christians (*Garden and Forest*, ii. 602, f. 153. — *Kew Bull. Miscellaneous Information*, vi. 226).

The Oak kermes is produced in the countries of southern Europe and northern Africa, and is obtained by removing by hand from the leaves and twigs just before the hatching time in May and June the excrescences caused by the deposit of the eggs of the insect (*Coccus Ilicis*, Linnæus). The kermes as soon as gathered are subjected to the fumes of heated vinegar, which destroy the fecundity of the eggs and turn them to a dull red color. Although now replaced by other coloring materials in the United States and England, the kermes of the Oak are still largely employed in southern Europe and in Algeria in dyeing leather and woolens. In Italy they are used in coloring liquids, and in France in various cosmetics and pharmaceutical preparations (A. Richard, *Hist. Nat. Méd.* i. 318. — G. Planchon, *Le Kermès du Chêne aux Points de Vue Zoologique, Commercial & Pharmaceutique.* — Spons, *Encyclopædia of the Industrial Arts, Manufactures, and Raw Commercial Products*, i. 861).

[37] Schoepf, *Mat. Med. Amer.* 138. — Griffith, *Med. Bot.* 585. — Johnson, *Man. Med. Bot. N. A.* 249. — *U. S. Dispens.* ed. 16, 1260.

[38] A. Richard, *l. c.* iii. 157. — Endlicher, *Med. Pfl.* 113. — Woodville, *Med. Bot.* ii. 344, t. 126. — Flückiger & Hanbury, *Pharmacographia*, 534. — Baillon, *Traité Bot. Med.* 1006.

[39] *U. S. Dispens.* ed. 16, 1261.

[40] Incarville, *Mémoires Concernant les Chinois*, ii. 588. — Bertrand, *Annales Forestières*, ii. 644. — Meadows, *Commercial Report on the Consular District of New-chwang* (*Commercial Reports from Her Majesty's Consuls in China and Japan*, 1865, 257). — McCartee, *North China Branch Asiat. Soc.* n. ser. iii. 75. — Hance, *Jour. Linn. Soc.* x. 482 ; xiii. 7. — Bretschneider, *On Chinese Silk-worm Trees*, 3. — Rein, *Industries of Japan*, 205.

[41] Thunberg, *Fl. Jap.* 177 (1784). — Blume, *Mus. Bot. Lugd. Bat.* i. 297. — Miquel, *Ann. Mus. Lugd. Bat.* i. 105. — A. de Candolle, *l. c.* 13. — Hance, *Ann. Sci. Nat.* sér. 5, v. 243. — Franchet & Savatier, *Enum. Pl. Jap.* i. 445. — Franchet, *Nouv. Arch. Mus.* sér. 2, v. 272 (*Pl. David.* i.).

Quercus obovata, Bunge, *Mém. Sav. Étr. St. Pétersbourg*, ii. 136 (*Enum. Pl. China-Bor.*) (1835). — A. de Candolle, *l. c.* 13.

Quercus pinnatifida, Franchet & Savatier, *l. c.* (1875).

This species, which is common on the hills in the neighborhood of Peking and on the borders of Mongolia, is very abundant in southern Yezo and northern Hondo, where, on gravelly plains little above the level of the ocean, it often grows to the height of eighty feet and forms trunks three feet in diameter ; farther south in Japan it is rare, and is found only on high mountain-slopes. The bark of *Quercus dentata* is used in Japan for tanning leather and in the preparation of a black dye. The wood, which is coarse-grained, porous, and brittle, is considered worthless except for fuel. As an ornamental tree it is occasionally cultivated in Japan, where it is the only deciduous-leaved Oak-tree seen in gardens. *Quercus dentata* was introduced several years ago into the gardens of Europe, and into those of the United States, where it grows rapidly, being hardy as far north as eastern Massachusetts. A variety of this species, with deeply pinnatifid leaves, is also occasionally cultivated by the Japanese (Sargent, *Forest Flora of Japan*, 67, t. 23).

[42] Thunberg, *l. c.* 176 (1784). — Blume, *l. c.* 296. — Miquel, *l. c.* 105. — A. de Candolle, *l. c.* 50. — Franchet & Savatier, *l. c.* 447. — Franchet, *l. c.* 275.

This small tree, with leaves hardly distinguishable from those of the Chestnut-tree, is very common on the coast and lower foothills of central Hondo, where it springs up on rough uncultivated land, and is planted in some of the silk districts of Japan to supply food for the oak-feeding silk-worms. The wood is used in large quantities for charcoal, and from the bark a black dye is made. *Quercus serrata* is said to be common in southern Manchuria, Corea, and several of the Chinese provinces, and is probably one of the Chinese silk-worm Oaks. It occurs also in India, on the Shan and Kasia hills, and in Natal and Sikkim, in a form with broader stipules and ovate-lanceolate cup-scales, distinguished as : —

Quercus serrata, β *Roxburghii*, A. de Candolle, *l. c.* 51 (1864). — G. King, *Ann. Bot. Gard. Calcutta*, ii. (*Indo-Malayan Species of Quercus and Castanopsis*), 22, t. 16.

Quercus serrata, Brandis, *Forest Fl. Brit. Ind.* 486 (1874). — Hooker f. *Fl. Brit. Ind.* v. 601.

[43] Forbes, *Jour. Bot.* xxii. 83 (1884). — Franchet, *l. c.* 275.

Quercus Chinensis, Bunge, *l. c.* 135 (not R. Brown) (1835). — A. de Candolle, *l. c.* 50.

Quercus serrata, α *Chinensis*, Wenzig, *Jahrb. Bot. Gart. Berlin*, iv. 221 (1886).

This is a common tree on the mountains of northeastern China. The leaves resemble those of the Chestnut-tree, and are not easily distinguished from those of *Quercus serrata*, and Dr. Bretschneider (*l. c.* 4) believes that this was the Chestnut-leaved Oak of Incarville (*l. c.* 181), which afforded food to the wild silk-worm. In China a black dye is made from the cups. *Quercus Bungeana* was introduced by Dr. Bretschneider into the Arnold Arboretum in 1882, and has proved a vigorous and hardy tree in the climate of eastern Massachusetts.

[44] *Antheræa Roylei*, Moore, *Proc. Zoöl. Soc. London*, xxvii. 256. — Balfour, *Cyclopædia of India*, ed. 3, iii. 634.

[45] Roxburgh, *Fl. Ind.* ed. 2, iii. 642 (1832). — A. de Candolle, *l. c.* 51. — Miquel, *l. c.* 111. — Hooker f. *l. c.* 603. — G. King, *l. c.* 26, t. 20.

Quercus lanata, α *incana*, Wenzig, *l. c.* 222 (1886).

This is a small, deciduous-leaved, gregarious tree, common on the outer ranges of the Himalayas, where it is distributed from the Indus to Nepaul, and in the Shan States of upper Burmah. The wood, which is hard and heavy, is used in construction, for agricultural implements, and for charcoal. The bark is used in tanning, and the leaves and young branches are fed to sheep and goats. The nuts are devoured by many animals, and are employed in native medicine as a diuretic and in the treatment of gonorrhœa (Brandis, *Forest Fl. Brit. Ind.* 482. — Gamble, *Man. Indian Timbers*, 384).

[46] Evelyn, *Sylva*, 15. — Strutt, *Sylva Britannica*. — Loudon, *Arb. Brit.* iii. 1731.

[47] Nearly two hundred years have passed since American Oaks were first introduced into European plantations, and during the last century efforts have been made at different times to cultivate them on a large scale in various European countries, but the results of these experiments cannot be considered satisfactory or encouraging. Large and flourishing specimens of *Quercus rubra*, generally called *Quercus coccinea*, and of *Quercus palustris*, can be found in some of the old collections of France and Germany; but, so far as I have been able to observe, these are the only American species which grow to a large size in Europe; and I have never seen in any of the countries of Europe that I have visited a vigorous or healthy American White Oak, either large or small, although large specimens of *Quercus alba* and *Quercus macrocarpa* are said to grow in the Botanic Garden of Turin (*Garden and Forest*, ii. 508).

[48] Thunberg, *Fl. Jap.* 175 (1784). — Blume, *Mus. Bot. Lugd. Bat.* i. 302. — Miquel, *Ann. Mus. Lugd. Bat.* i. 115. — A. de Candolle, *Prodr.* xvi. pt. ii. 100. — Franchet & Savatier, *Enum. Pl. Jap.* i. 448. — Hance, *Jour. Bot.* xiii. 363. — Forbes, *Jour. Bot.* xxii. 84.

The nuts of *Quercus glauca* are eaten by the Japanese, and are of considerable comestible and commercial importance.

[49] Thunberg, *l. c.* 175 (1784). — Blume, *l. c.* 299. — Miquel, *l. c.* 115. — A. de Candolle, *l. c.* 91. — Franchet & Savatier, 484.

Quercus marginata, Blume, *l. c.* 304 (1855). — Miquel, *l. c.* — A. de Candolle, *l. c.* 106.

Quercus Buergerii, Blume, *l. c.* 299 (1850). — Miquel, *l. c.* — A. de Candolle, *l. c.*

[50] Thunberg, *l. c.* (1784). — Siebold & Zuccarini, *Fl. Jap.* i. 170, t. 89. — Blume, *l. c.* 289. — Miquel, *l. c.* 106. — A. de Candolle, *l. c.* 82. — Franchet & Savatier, *l. c.* 447.

[51] Thunberg, *l. c.* 176 (1784). — Siebold & Zuccarini, *l. c.* 8, t. 2. — Blume, *l. c.* 288. — Miquel, *l. c.* 117. — A. de Candolle, *l. c.* 103. — Franchet & Savatier, *l. c.* 449.

Quercus cuspidata is the most widely distributed evergreen Oak of Japan, often forming extensive forests in southern Hondo, where it ranges farther north than other species with persistent foliage; and is more frequently planted by the Japanese as an ornamental tree than any other Oak. Always a beautiful object, with its abundant lustrous dark green foliage, it is most lovely in early spring, when it is covered with white and bright red young shoots and leaves. Its nuts are edible when cooked, and are sold in the Japanese markets.

The most valuable edible mushroom of Japan takes its name, Shii-take, from the Japanese name of this tree, upon the dead and rotten stumps and roots of which it grows, as well as upon those of some other Oaks. The artificial production of the Shii-take upon pieces of the bark of *Quercus cuspidata* is an important industry in several provinces, great quantities of this agaricus being consumed in soup in Japan, and exported to China. (See Robertson, *Commercial Reports by Her Majesty's Consuls in Japan*, 1875, 52.)

[52] Quercus in its different species is known to afford support to a much larger number of insects than any other genus of trees whose insect enemies have been studied. Five hundred and thirty-seven species are reported as occurring on the Oaks of central Europe (Kaltenbach, *Die Pflanzenfeinde aus der Klasse der Insecten*, 1874, 643); and Packard enumerates about four hundred and fifty identified species as living upon Oak-trees in North America, exclusive of those found in their decayed wood (*Fifth Rep. U. S. Entomolog. Comm.* 1890, 48). Between one hundred and two hundred species have been noted but not identified or recorded, and further studies of the insects infesting Oaks in the southern and western parts of the continent will, no doubt, greatly lengthen this list.

A large number of the insects found on Quercus also feed upon other trees, although many of them are monophagous, living entirely on the plants of this genus, and being either peculiar to a single species or to a group of closely allied species.

Besides affording support to some gall-making insects, the roots of Oak-trees in the southern states are often infested by the boring larvæ of a large beetle, *Mallodon melanopus*, Linnæus. *Quercus Virginiana* seems particularly affected by this insect, the large grubs causing the young trees to become stunted and scrubby, great root-masses being often produced without a corresponding development of trunk, and trees over large areas being thus dwarfed and rendered valueless. The larvæ of the large *Prionus laticollis*, Drury, in the northern states are believed to live in the roots of Oaks as well as in those of other trees. A large proportion of the borers found in the trunks of Oaks only attack them after the trees are injured or dead, or have been felled and the timber has begun to dry. Among the insects affecting the living trunks, the larva of a large Cossid moth, *Prionoxystus Robiniæ*, Peck, is considered one of the most destructive. It makes circular holes about half an inch in diameter, which sometimes extend to the heart of the tree (Fitch, *Fifth Rep. Insects of New York*, 4); and Oak-trunks are also affected by the larvæ of other moths of the same group. *Cossus Querciperda*, Fitch, *Cossus reticulatus*, Lintner, and *Cossula magnifica*, Bailey, occur in various parts of the country, the last two being particularly noticeable through their injuries to *Quercus Virginiana* in some of the southern states.

Quercus alba and other species are believed to be among the original food-plants of the Flat-headed Borer, *Chrysobothris femorata*, Fabricius, now so injurious to Apple and other fruit-trees, and the Oak is still a favorite food-plant of this insect. Other species of *Chrysobothris* affect the Oaks, apparently most often after the trees have been injured or the wood has begun to dry. *Eupsalis minuta*, Drury, bores into the solid wood, and *Liopus Querci*, Fitch, is also said to infest these trees. Species of many other genera of beetles attack their wood, but in nearly all cases after the tree is dead or has begun to decay, among the most common being species of Phymatodes, Xylotrechus, Graphisurus, Goes, Xyleborus, and Pityophthorus. In its beetle state *Pityophthorus pubipennis*, Leconte, has been reported as sometimes very abundant on newly felled trees in the Pacific forests, while in the east *Pityophthorus Querciperda*, Schwarz, bores through and under the bark of dead Oak-trees.

Oaks are often much damaged by the Oak-pruner, *Elaphidion villosum*, Fabricius, a beetle which lays its eggs on the young twigs, and whose larvæ, after boring into the branches, cut them off, causing them to fall in large quantities to the ground (J. B. Smith, *Garden and Forest*, v. f. 94, 95); and the Seventeen-year Cicada, *Cicada septendecim*, Linnæus, sometimes causes much injury to Oak branches by the incisions made in depositing its eggs. A species of woolly aphis, *Eriosoma Querci*, Fitch, is occasionally abundant on the branches of Oak-trees, and among scale-insects several species of Chermes, *Chionaspis Quercus*, Comstock, *Rhizococcus Quercus*, Comstock, *Lecanium Quercitronis*, Fitch, *Lecanium Quercifex*, Fitch, and others sometimes do them considerable injury.

The majority of insect species affecting the Oak prey, however, upon its foliage, but their number is too great for specific enumeration here. The Web-worms, or Tent-caterpillars, are often destructive, and *Clisiocampa disstria*, Hübner, and *Hyphantria cunea*, Drury, are especially noticeable in the east, while *Clisiocampa Californica*, Packard, and *Clisiocampa constricta*, Stretch, sometimes strip Oak-trees of their foliage in the Pacific forests. In California the larvæ of *Phryganidia Californica*, Packard, are frequently very injurious to Oaks, upon which they are said to feed almost exclu-

sively. The orange and yellow colored caterpillars of *Anisota senatoria*, Hübner, *Anisota pellucida*, Hübner, and *Anisota Stigma*, Hübner, often denude whole trees, the first two being northern and the last southern in range. The prickly stinging caterpillars of *Hemileuca Maia*, Drury, as well as various species of Datana and of Orgyia, or Tussock Moths, commonly feed on Oaks over a large portion of the continent.

Lochmæus manteo, Doubleday, has been reported as quite injurious in several localities. The larvæ of a number of species of Bombycidæ, including several silk-worm moths, like *Telea Polyphemus*, Hübner, are common on Oaks. Noctuidæ are also abundant upon them, and of this group many species of the genus Catocala make them their food-plant, being, however, rarely very troublesome.

Various Leaf-rollers are common on Oak-trees, among them being *Tortrix quercifoliana*, Fitch, and other allied species, and species of Cacœcia, Cenopis, Gelechia, and other genera, each rolling or folding the leaves or parts of the leaves in the manner peculiar to itself. *Cryptolechia quercicella*, Clemens, and *Cryptolechia Schlagenella*, Zeller, live between the surfaces of leaves which they draw and fasten together by silken threads.

Forty or fifty species of Leaf-miners belonging to the family Tineidæ, and principally to the genera Lithocolletis, Tischeria, and Nepticula, have been described as harbored by American Oaks. Their small larvæ cause blotches or slender mines or tunnels of various forms, and mostly live within and feed upon the parenchyma of the leaves, the epidermal surfaces being left intact except at the points of ingress or egress. Larvæ of *Selandria Quercus-alba*, Norton, and other Saw-flies, sometimes injure the leaves of Oak-trees; various species of aphids are common upon them, and Red Mites, *Tetranychus telarius*, Linnæus, in dry seasons sometimes cause them to turn gray.

Many forms of galls on leaves and twigs, and also on flowers, fruits, and roots, are well known where Oaks abound. Some are characteristic of and peculiar to certain single species of the genus, while others occur on several allied species. These galls are mostly produced by insects of the Hymenopterous family, Cynipidæ, about one hundred and fifty species of which have been described as occurring on the various Oaks of North America, although a few are recorded as the work of the Dipterous family, Cecidomyidæ, and of Mites. The large round Oak-apple, *Amphibolips spongifica*, Osten-Sacken, common on *Quercus velutina*, is one of the most conspicuous of Cynipidous galls. Many American Oak-galls are rich in tannic and gallic acids, but have rarely been used as a substitute for the officinal Oak-galls of southeastern Europe and Asia Minor. The full life-histories of most of our species of gall-making Cynipidæ are still unknown, and it is probable that future studies of them will reduce the list of so-called species, as it has been shown that the alternating generations of some species produce galls of such different structure and appearance that they have even been regarded as members of distinct genera. (See Adler, *Zeit. für Wissen. Zool.* xxxv. 151, t. 10–12 [*Über den Generationswechsel der Eichen-Gallwespen*].)

In all parts of the country the fruit of different species of Quercus is often seriously infested by weevils of various species of the genus Balaninus. *Balaninus nasicus*, Say, seems to prefer the species with annual maturation, while *Balaninus Quercus*, Horn, has only been observed on biennial-fruited species, which *Balaninus uniformis*, Leconte, also appears to prefer. (See J. Hamilton, *Canadian Entomologist*, xxii. 1.) The work of these weevils often destroys a large part of the fruit of Oak-trees, that of *Quercus rubra* being particularly liable to their attacks. Their eggs are deposited by the beetles in the ovaries of the flowers, no scars being left on the acorns, and in the autumn the larvæ emerge.

[53] The number of parasitic fungi known to affect Oak-trees in the United States exceeds that accredited to the trees of any other American genus, several hundred species being recorded, chiefly as infesting *Quercus alba*, *Quercus velutina*, *Quercus coccinea*, and *Quercus rubra*. It is not probable, however, that these species are more liable to the attacks of fungal diseases than other American Oak-trees, and the great number known to afflict them can probably be accounted for by the fact that they are exceedingly abundant in those parts of the country where fungi have been most carefully studied. Nearly fifty species of fungi are parasitic on *Quercus agrifolia*, and many species are found on *Quercus Marilandica* and *Quercus Virginiana*. Only a single fungal parasite is known thus far on *Quercus Californica* and *Quercus Wislizeni*, but the fungal diseases of California Oaks have not as yet been carefully examined.

Notwithstanding the large number of parasites on North American Oaks which are known to systematic botanists, scarcely anything has been done in studying the special diseases which they cause. When American trees are studied from the point of view of European scientific foresters, it will, no doubt, be found that many of the fungi now recognized produce serious diseases in our Oaks. Many of the species of Polyporus and its allies, which are known to cause rotting of Oak wood in Europe, are common in the United States, and probably do the same damage here. *Dædalea quercina*, Persoon, appears to be less common here than in Europe, although it is found not infrequently. But one fungal disease of Quercus has attracted much attention in the United States, and this only in recent years. It is a leaf disease caused by *Glœosporium Canadense*, Ellis & Everhart, which most frequently attacks *Quercus alba*, although it is probably not distinct from a similar disease of *Quercus coccinea*, *Quercus rubra*, and other species. It appears in late spring and early summer as soon as the leaves have grown to their full size, and is characterized by the presence of brown patches near their tips and margins. These dead portions gradually increase in size, and the diseased leaves curl and shrivel. When the attack is serious, a large part of the foliage of the tree is affected; but, as a rule, only certain leaves are attacked, and when they at last fall off there is at least an attempt on the part of the tree to produce a new crop in their place. This fungus as seen externally consists of small dots, hardly visible to the naked eye, which are scattered irregularly over the surface of the leaves, and scarcely differ in color from the parts already dead. The disease has attracted attention principally in the northern and eastern states, where Oaks are grown for shade and ornament, and where the injured foliage is, therefore, especially noticeable. It occurs, however, even more frequently on trees growing in the forest.

Another common disease undoubtedly injurious to young Oak-trees, and especially to *Quercus rubra*, although by no means limited to this species, is caused by *Nummularia Clypeus*, Cooke. It attacks the smaller branches, breaking through the outer bark in elongated cone-like black patches several inches or even one or two feet in length, but usually not more than two inches in breadth. Its development is slow, the patches, which hardly rise above the general surface of the bark, remaining on it for months, and then finally crumbling away, leaving the smaller branches quite dead and marking the larger ones with unsightly wounds. This parasite belongs to the Pyrenomycetes, an order including a large number of fungi which grow on Oaks, some of them, like *Nummularia punctulata*, Saccardo, and *Anthostoma atropunctata*, Saccardo, producing diseases similar to that caused by *Nummularia Clypeus*.

Another fungus, *Taphrina cærulescens*, Tulasne, is common on the leaves of *Quercus alba*, *Quercus agrifolia*, *Quercus nigra*, *Quercus coccinea*, *Quercus laurifolia*, *Quercus macrocarpa*, and probably also on other species, ranging as it does from New England to the Gulf states and to California. It forms grayish or bluish gray spots on the under surface of the leaves, without causing any perceptible distortion, and is most abundant in early summer. Botanically it is nearly related to the fungus which causes the curl of Peach-leaves.

From the attacks of Rust-fungi American Oaks appear to be nearly exempt, although *Uredo Quercus*, Brondeau, of southern Europe, occurs also to some extent in our southern states on the leaves of *Quercus Phellos* and *Quercus Virginiana*.

The mildews which infest Oak-trees, apart from the ubiquitous Phyllactinia, belong to the genus Microsphæra, *Microsphæra quercina*, Burrill, being abundant and widely distributed in the region east of the Mississippi River on several species of Quercus. A mildew, *Sphærotheca lanestris*, Harkness, infests the twigs of *Quercus agrifolia*.

Venturia Orbicula, Cooke & Peck, forms numerous small black spots arranged in circles on Oak leaves. *Coccomyces triangularis*, Saccardo, which is common on *Quercus alba*, is easily recognized by its habit of rupturing the bark in triangular spots. *Polyporus graveolens*, Fries, one of the large punk-fungi, is found on *Quercus nigra* and *Quercus Catesbœi* in the southern states; and the beefsteak fungus, *Fistulina Hepatica*, Fries, one of the best edible fungi, grows on the trunks of Oaks and Chestnut-trees.

[54] Cobbett, *Woodlands*, No. 422.

[55] Among the North American species of Quercus the White Oaks are much more difficult to transplant than the Black Oaks or biennial-fruited species, and only small seedlings can be safely removed. Black Oaks of comparatively large size can, however, be transplanted without much danger or trouble, and plants ten to fifteen feet high are often taken from the woods and successfully set in the streets of the cities of the southern states.

[56] *Inst.* 582–584, t. 349, 350.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

LEPIDOBALANUS. Aments of the staminate flowers pendulous; stigmas dilated.

Leucobalanus. Abortive ovules basal or rarely lateral; stamens usually from 6 to 8; stigmas sessile or subsessile; nut glabrous or rarely pubescent on the inner surface. White Oaks.

Maturation annual; nut glabrous on the inner surface (except No. 26); abortive ovules basal.

Leaves falling in the autumn (except No. 13).

Yellow-green.

Lyrate or sinuate-pinnatifid.

Obovate-oblong, obliquely 3 to 9-lobed or pinnatifid, pale and glabrous below	1. Q. ALBA.
Oblong or obovate, deeply lobed, usually stellate-pubescent on the upper surface, pale and pubescent on the lower	2. Q. LOBATA.
Oblong, acutely lobed, stellate-pubescent on the upper surface	3. Q. BREWERI.
Obovate or oblong, coarsely pinnatifid-lobed	4. Q. GARRYANA.
Obovate or oblong-lanceolate, lobed or pinnatifid, pubescent on the lower surface	5. Q. GAMBELII.
Oblong-obovate, usually 5-lobed, pubescent on the lower surface, roughened with stellate hairs on the upper	6. Q. MINOR.
Oblong or oblong-obovate, entire or slightly sinuate-lobed toward the apex	7. Q. CHAPMANI.
Obovate or oblong, lyrately pinnatifid or deeply sinuate-lobed or divided, usually pale and pubescent on the lower surface	8. Q. MACROCARPA.
Obovate-oblong, deeply 5 to 9-lobed or pinnatifid, pubescent and usually silvery white on the lower surface	9. Q. LYRATA.

Coarsely sinuate-toothed. Chestnut Oaks.

Obovate or oblong to lanceolate-acuminate, with rounded or acute teeth	10. Q. PRINUS.
Oblong to lanceolate, acute or acuminate or broadly obovate, puberulous and pale, often silvery white on the lower surface	11. Q. ACUMINATA.
Obovate-oblong, wedge-shaped at the base, soft-pubescent and often silvery white on the lower surface	12. Q. PRINOIDES.
Oval to obovate, thick and coriaceous, pale and usually puberulous on the lower surface, persistent during the winter	13. Q. SADLERIANA.
Obovate or oblong-obovate, generally sinuate-dentate or lobed, pubescent and usually hoary on the lower surface	14. Q. PLATANOIDES.

Obovate or oblong-obovate, wedge-shaped or rounded at the broad or narrow base, tomentose or pubescent and often silvery white on the lower surface . . . . . 15. Q. MICHAUXII.

Blue-green.

Obovate or oblong, undulate, lobed or entire, pale and often silvery white and pubescent on the lower surface . . . . . 16. Q. BREVILOBA.

Oblong, sinuate-dentate, entire, pinnatifid-lobed or spinescent, pubescent on the lower surface . . . . . 17. Q. UNDULATA.

Oblong, lobed, spinescent or entire, pubescent on the lower surface . . . 18. Q. DOUGLASII.

Leaves mostly persistent until the appearance of those of the following spring.

Blue-green.

Oblong or obovate, usually obtuse and rounded at the apex, entire or remotely dentate . . . . . 19. Q. ENGELMANNI.

Ovate, oval or obovate, usually cordate, entire or remotely spinulose-dentate . . . . . 20. Q. OBLONGIFOLIA.

Oblong-lanceolate to broadly obovate, cordate or rounded at the base, spinose-dentate, pubescent and conspicuously reticulate-venulose on the lower surface . . . . . 21. Q. ARIZONICA.

Broadly obovate, cordate, usually rounded and obtuse at the apex, repandly spinose-dentate, coarsely reticulate-venulose . . . . . 22. Q. RETICULATA.

Ovate or ovate-oblong or oval, entire or remotely spinose-dentate . . . 23. Q. TOUMEYI.

Dark green.

Oblong or obovate, entire, sinuate-toothed, or lobed, pubescent and often pale on the lower surface . . . . . 24. Q. DUMOSA.

Oblong, elliptical or obovate, entire or remotely spinose-dentate, pale or silvery white on the lower surface . . . . . 25. Q. VIRGINIANA.

Oblong-lanceolate, entire or repand-serrate, coriaceous . . . . . 26. Q. EMORYI.

Maturation biennial; nut sericeo-tomentose on the inner surface; abortive ovules basal or lateral.

Leaves persistent.

Oblong, acute or cuspidate, entire or dentate or sinuate-toothed, fulvous-tomentose and ultimately pale on the lower surface . . . . . 27. Q. CHRYSOLEPIS.

Oblong-lanceolate, acute, crenate-dentate or entire, conspicuously veined, pubescent or tomentose on the lower surface . . . . . 28. Q. TOMENTELLA.

Melanobalanus. Abortive ovules superior; stamens usually from 4 to 6; styles elongated, finally recurved; nut sericeo-tomentose on the inner surface. Black Oaks.

Maturation annual.

Leaves persistent until the appearance of those of the following year.

Oval, orbicular or oblong, entire or sinuately spinose-dentate, convex on the upper surface . . . . . 29. Q. AGRIFOLIA.

Oblong or elliptical, or oblong-obovate, usually entire, glabrous or coated with pale pubescence on the lower surface . . . . . 30. Q. PUMILA.

Maturation usually biennial.

Leaves persistent until the appearance of those of the following year.

Lanceolate, oblong-lanceolate or elliptical, entire or spinose-dentate toward the apex, coated with pale or fulvous tomentum on the lower surface . 31. Q. HYPOLEUCA.

Oblong-lanceolate, entire or sinuate-dentate, dark green and lustrous . . 32. Q. WISLIZENI.

Oval to oblong-obovate, rounded or acute at the apex, mostly entire, with thickened revolute margins . . . . . 33. Q. MYRTIFOLIA.

Leaves deciduous.

Pinnatifid or lobed.

Oblong-obovate to oblong, the lobes tapering gradually from broad bases and acute and usually dentate at the apex . . . . . 34. Q. RUBRA.

Obovate, truncate or abruptly wedge-shaped at the base, deeply lobed with broad rounded sinuses, the lobes sinuate-dentate at the usually broad apex . . . . . 35. Q. TEXANA.

Oblong or obovate, deeply lobed with broad rounded sinuses, the slender lobes coarsely repand-dentate toward the apex . . . . . 36. Q. COCCINEA.
Ovate or obovate, slightly or deeply lobed with broad or narrow nearly entire or dentate lobes, usually pubescent on the lower surface . . . 37. Q. VELUTINA.
Oblong or obovate, deeply lobed, the lobes tapering, acute, or broad and obovate at the apex, repand-dentate or entire, glabrous or pubescent on the lower surface . . . . . 38. Q. CALIFORNICA.
Oblong-obovate or triangular, deeply lobed with acute spreading often falcate lobes, glabrous or rusty-pubescent on the lower surface . . . 39. Q. CATESBEI.
Oblong or obovate, fulvous or pale pubescent on the lower surface, the lobes usually elongated and falcate . . . . . 40. Q. DIGITATA.
Obovate, sinuate-lobed by deep wide sinuses, the spreading lobes acute or obtuse, usually coarsely repand-dentate . . . . . 41. Q. PALUSTRIS.
Obovate, mostly acutely 5-lobed, coated on the lower surface with pale pubescence . . . . . 42. Q. NANA.
Oval or obovate, glabrous, sinuately lobed with usually acute entire lobes . 43. Q. GEORGIANA.
Widening upward, and often abruptly dilated at the broad, sinuate or obscurely 3 to 5-lobed apex.
Broadly obovate, rusty-pubescent on the lower surface . . . . . 44. Q. MARILANDICA.
Obovate-spatulate or narrowly wedge-shaped, glabrous . . . . . 45. Q. NIGRA.
Oblong or lanceolate-obovate, usually entire. Willow Oaks.
Glabrous, dark green and lustrous above, somewhat paler below . . . . 46. Q. LAURIFOLIA.
Pale blue-green and glabrous above, coated below with hoary tomentum . 47. Q. BREVIFOLIA.
Dark green or lustrous on the upper surface, pubescent on the lower . . 48. Q. IMBRICARIA.
Glabrous, narrowed at both ends . . . . . 49. Q. PHELLOS.

PASANIA. Pistillate flowers in 3-flowered cymes at the base of the erect androgynous aments; abortive stamens as many as the calyx-lobes; stigmas linear.
Leaves persistent.
Oblong, entire or dentate, tomentose on the lower surface . . . . . 50. Q. DENSIFLORA.

QUERCUS ALBA.

White Oak.

LEAVES obovate-oblong, obliquely, usually 7-lobed, or pinnatifid, pale and glabrous below.

Quercus alba, Linnæus, *Spec.* 996 (1753). — Miller, *Dict.* ed. 8, No. 11. — Muenchhausen, *Hausv.* v. 253. — Du Roi, *Harbk. Baumz.* ii. 270, t. 5, f. 5. — Wangenheim, *Beschreib. Nordam. Holz.* 56; *Nordam. Holz.* 12, t. 3, f. 6. — Lamarck, *Dict.* i. 720. — Marshall, *Arbust. Am.* 119. — Moench, *Bäume Weiss.* 95. — Evelyn, *Silva*, ed. Hunter, i. 70. — Walter, *Fl. Car.* 235. — Castiglioni, *Viag. negli Stati Uniti*, ii. 348. — Abbot & Smith, *Insects of Georgia*, ii. 173, t. 87. — Borkhausen, *Handb. Forstbot.* i. 708. — Willdenow, *Berl. Baumz.* 276; *Spec.* iv. pt. i. 448; *Enum.* 977. — Michaux, *Hist. Chênes Am.* No. 4; *Fl. Bor.-Am.* ii. 195. — Muehlenberg & Willdenow, *Neue Schrift. Gesell. Nat. Fr. Berlin*, iii. 395. — Persoon, *Syn.* ii. 570. — Bosc, *Mém. Inst. Sci. Phys. Math. Paris*, viii. pt. i. 340. — Desfontaines, *Hist. Arb.* ii. 508. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 423. — Stokes, *Bot. Mat. Med.* iv. 413. — Michaux f. Hist. *Arb. Am.* ii. 13, t. 1. — Pursh, *Fl. Am. Sept.* ii. 633. — Bigelow, *Fl. Boston.* 225. — Nuttall, *Gen.* ii. 215; *Sylva*, i. 14. — *Nouveau Duhamel*, vii. 175. — Hayne, *Dendr. Fl.* 158. — Elliott, *Sk.* ii. 607. — Sprengel, *Syst.* iii. 864. — Audubon, *Birds*, t. 107, 147. — Hooker, *Fl. Bor.-Am.* ii. 158. — Spach, *Hist. Vég.* xi. 155. — Torrey, *Fl. N. Y.* ii. 192. — Emerson, *Trees Mass.* 127, t. 1; ed. 2, i. 145, t. — Dietrich, *Syn.* v. 311. — Darlington, *Fl. Cestr.* ed. 3, 266. — Brendel, *Trans. Ill. Agric. Soc.* iii. 613, t. 1. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 31. — Chapman, *Fl.* 423. — A. de Candolle, *Prodr.* xvi. pt. ii. 22. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 66; *Liebmann Chênes Am. Trop.* t. 33, f. 29, 30, 58, 59. — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 341. — Vasey, *Am. Ent. and Bot.* ii. 249, f. 156. — Koch, *Dendr.* ii. pt. ii. 50. — Bentley & Trimen, *Med. Pl.* iv. 250, t. 250. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 137. — Lauche, *Deutsche Dendr.* 294. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 177. — Houba, *Chênes Am. en Belgique*, 235, t. — Mayr, *Wald. Nordam.* 141, t. 1, 2. — Watson & Coulter, *Gray's Man.* ed. 6, 475. — Dippel, *Handb. Laubholzk.* ii. 74. — Koehne, *Deutsche Dendr.* 127. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 414 (*Man. Pl. W. Texas*).

Quercus alba pinnatifida, Michaux, *Hist. Chênes Am.* No. 4, t. 5, f. 1 (1801); *Fl. Bor.-Am.* ii. 195. — Loudon, *Arb. Brit.* iii. 1864.

Quercus alba (repanda), Michaux, *Hist. Chênes Am.* No. 4, t. 5, f. 2 (1801). — Pursh, *Fl. Am. Sept.* ii. 633. — Hayne, *Dendr. Fl.* 159. — Loudon, *Arb. Brit.* iii. 1864. — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 342. — Dippel, *Handb. Laubholzk.* ii. 75.

Quercus alba, α pinnatifido-sinuata, Hayne, *Dendr. Fl.* 158 (1822).

Quercus alba, β sinuata, Hayne, *Dendr. Fl.* 159 (1822).

Quercus alba, γ microcarpa, A. de Candolle, *Prodr.* xvi. pt. ii. 22 (1864). — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 342.

A tree, growing to an average height of from eighty to one hundred feet, with a trunk three or four feet in diameter. The principal limbs are stout, and, spreading irregularly from the stem at a broad angle and in a slightly zigzag manner, form an open crown of rather slender rigid branches. Crowded by other trees in the forest, the White Oak sometimes grows to a height of one hundred and fifty feet, its trunk rising from a base occasionally six feet in diameter, tapering gradually to the first branches, which are often seventy or eighty feet above the ground, and bearing a comparatively narrow head. When, however, it has grown in the full enjoyment of light and air, the White Oak is low and round-headed, with a short gnarled trunk occasionally twelve feet in diameter and great wide-spreading branches which are often contorted toward their extremities. The bark of the trunk and large branches is light gray slightly tinged with red or brown, or occasionally nearly white, and is broken into thin appressed scales; on large trunks it is sometimes two inches in thickness, and is divided into broad flat ridges by shallow fissures. The branchlets are slender, and are marked with minute pale lenticels; and at first are bright green and often tinged with red, and coated with a loose tomentum of long pale or ferrugineous hairs, which soon disappears, falling in large irregular patches; during the summer they turn reddish brown, in their first winter are bright red and lustrous or are coated with a glaucous bloom, and in their second year become ashy gray. The winter-buds are broadly ovate, rather

obtuse, dark red-brown, and about an eighth of an inch in length. The leaves are conduplicate in the bud, obovate-oblong and gradually narrowed and wedge-shaped at the base; they are divided into terminal lobes and from three to nine but usually three pairs of lateral lobes by wide sinuses, which are rounded at the bottom, and are sometimes shallow and sometimes penetrate nearly to the midribs; the terminal lobe is short or elongated, obovate and three-lobed, or occasionally ovate, entire and acute or rounded; the lateral lobes are oblique, broad or narrow, entire or auriculate, and increase in size from the base to the apex of the leaf; or on vigorous shoots or small branches developed from the trunks of old trees, the leaves are often repand or slightly sinuately lobed or occasionally entire below and three-lobed at the broad apex; when they unfold they are bright red above, pale below, and coated with soft pubescence; the red color fades at the end of a few days, and they become silvery white and very lustrous; their covering of tomentum then gradually disappears, and when fully grown the leaves are thin, firm, and glabrous, bright green and lustrous or dull on the upper surface, pale or glaucous and glabrous below, and from five to nine inches in length, with stout bright yellow midribs, conspicuous primary veins running to the points of the lobes, lateral veins forked and united near the margins, conspicuous reticulate veinlets, and stout pale petioles flattened and grooved on the upper side and enlarged toward the base. The stipules are linear, brown, scarious, and about half an inch long. Late in the autumn, after the leaves of nearly all the trees with which it grows in the forest have fallen, those of the White Oak turn to a deep rich vinous red, and, gradually withering, drop at the beginning of winter or remain on the branches of some individuals nearly to its close. The staminate flowers, which appear when the leaves are about one third grown, are produced in hirsute or nearly glabrous aments from two and a half to three inches long; they are usually ebracteolate, and before opening are furnished at the apex with tufts of rusty brown hairs; the calyx is bright yellow and pubescent, with acute lobes rather shorter than the stamens, which are composed of comparatively stout filaments and emarginate glabrous anthers. The pistillate flowers are borne on abbreviated or elongated peduncles, the two forms often appearing on the same tree; they are bright red with broadly ovate hirsute involucral scales and ovate acute calyx-lobes. The acorn is sessile, or is borne on a slender peduncle from one to two inches in length, and is more often long-stalked on trees with deeply lobed leaves than on those with slightly divided leaves, although long and short-stalked acorns can be found on trees with leaves of either form, and often on the same tree and on the same branch; the nut is ovoid or oblong, rounded at the apex, lustrous, three quarters of an inch or an inch in length, green when fully grown, and finally light chestnut-brown; the cup is cup-shaped and coated outside with pale or light brown tomentum, and embraces about a quarter of the nut; at the base it is tuberculate by the much thickened and united scales, which are produced into short obtuse membranaceous tips; growing gradually thinner toward the top of the cup, the scales are small and scarious at the rim.

Quercus alba is distributed from southern Maine to southwestern Quebec, westward through central and southern Ontario,[1] the lower peninsula of Michigan and southern Minnesota[2] to southeastern Nebraska[3] and eastern Kansas,[4] and southward to northern Florida and the valley of the Brazos River in Texas. An inhabitant of sandy plains and gravelly ridges, of rich uplands, intervales, and moist bottom-lands, the White Oak is rare in Quebec and northern New England, where it is usually found mixed with the White Pine. It is abundant and grows to a large size in Ontario, frequently forming a considerable part of the forest-growth. Absent from the cold elevated regions of northern New England and New York, and from the highest slopes of the southern Alleghany Mountains, and rare in the maritime Pine belt of the south, the White Oak is common, where the soil is not too sterile to support it, in other parts of the United States from the shores of the Atlantic nearly to the western and northwestern limits of its range. While sometimes forming forests almost to the exclusion of other

[1] Brunet, *Cat. Vég. Lig. Can.* 48. — Bell, *Geolog. Rep. Can.* 1879–80, 52°. — Macoun, *Cat. Can. Pl.* 440.

[2] Macmillan, *Metaspermæ of the Minnesota Valley*, 192.

[3] Bessey, *Rep. Nebraska State Board Agric.* 1894, 109.

[4] Mason, *Eighth Bienn. Rep. State Board Agric. Kansas*, 271.

trees, it is often associated with the Hickories, the Red Oak, the Sour Gum, the White Ash, the Yellow Poplar, and the Cucumber-tree, and is most abundant and grows to its greatest height on the western slopes of the Alleghany Mountains in Tennessee and the Carolinas, and on the bottom-lands of the lower Ohio basin.[1] Usually smaller in the northeastern states, it is only in this part of the country, which was first cleared of its original forest covering, that low broad-branched short-trunked specimens are found. Individual trees believed to be natural hybrids of *Quercus alba* with *Quercus minor*,[2] *Quercus macrocarpa*,[3] and *Quercus Prinus*,[4] have been observed in different parts of the country.

[1] Ridgway, *Proc. U. S. Nat. Mus.* v. 78.

[2] A tree discovered by Mr. M. S. Bebb, near Fountaindale, Illinois, shows some of the characters of *Quercus alba* and *Quercus minor*, and is believed to be a hybrid between these species. The leaves resemble those of *Quercus alba* in general outline; the narrow lobes, however, are obovate and sometimes retuse, like those of *Quercus minor*, and they are coated on the under surface and on the petioles and young branches with soft pubescence. The cups are shallow and pubescent with regular distinct scales somewhat thickened at the base, and are thus intermediate between those of the two supposed parents (Engelmann, *Trans. St. Louis Acad.* iii. 398).

Near Silver Springs Station, in the neighborhood of the city of Washington, Dr. George Vasey discovered several years ago a tree of probably similar parentage. The leaves are oblong, rounded at the narrow base, and irregularly cut into narrow oblique or spreading lobes; more elongated than those of the ordinary forms of *Quercus alba*, which they otherwise generally resemble, they are thicker and firmer, however, darker green on the upper surface and slightly pubescent on the lower. The fruit is long-pedunculate, with obtuse nuts about three quarters of an inch in length, and shallow cups covered with distinct lanceolate acute or truncate scales slightly thickened near the base of the cup only. The bark is described as darker and closer than that of the White Oak. The buds and leaves are slightly modified from those of *Quercus alba*, while the fruit resembles that of *Quercus minor* (Vasey, *Bull. Torrey Bot. Club*, x. 25, t. 29).

A single tree (Plate ccclix.), found by Mr. George W. Letterman on Buckley's Hill, near Allenton, Missouri, has the habit, general appearance, and bark of *Quercus alba*. The buds, although rather larger, are like those of *Quercus minor*. The leaves, also, generally resemble those of this species in outline and in their broader obtuse lobes, although individual leaves with the narrow rounded oblique lobes of *Quercus alba* are frequent. While young they are coated with the tawny stellate pubescence of *Quercus minor*, and at maturity are glabrous, or pubescent with scattered stellate hairs on the upper surface, and pale, pubescent, or glabrate on the lower. The anthers, like those of *Quercus minor*, are hirsute. The nuts, which are about an inch in length, resemble those of *Quercus alba*, while the cup differs from that of common forms of *Quercus minor* only in the somewhat thicker scales at its base.

[3] A tree believed to be a hybrid between *Quercus alba* and *Quercus macrocarpa* was found several years ago by Mr. M. S. Bebb, near Fountaindale, Illinois. The leaves resemble those of *Quercus alba*, except in the pubescent covering on their lower surface, although some individual leaves are almost exactly like those of ordinary forms of *Quercus macrocarpa* in shape; like those of *Quercus alba* they turn deep red in the autumn. The cup is a little deeper than the cup of *Quercus alba*, with the prominent triangular scales of *Quercus macrocarpa* (Engelmann, *l. c.*).

Another tree of probably the same parentage, discovered near Athens, Illinois, by Mr. Elihu Hall, has the leaves of *Quercus macrocarpa*, although they are covered while young with the pubescence of *Quercus alba*. The bark and nuts are those of *Quercus alba*, while the deep cups, destitute of marginal fringe-like scales, resemble in form and in the character of their basal scales those of some of the smaller-fruited forms of *Quercus macrocarpa* (E. Hall, *Am. Ent. and Bot.* ii. 191. — Engelmann, *l. c.*).

A tree discovered near Charlotte, Vermont, by Mr. C. G. Pringle in 1879 (Plate ccclx.), and apparently a hybrid between *Quercus alba* and *Quercus macrocarpa*, has narrow or broadly obovate leaves, with the oblique lobes of *Quercus alba*, their sinuses being mostly regular and shallow, although some leaves are divided nearly to the middle by the deep broad sinuses so characteristic of *Quercus macrocarpa*. Some of the individual leaves are green and nearly glabrous on the under surface, and others are pale and more or less coated with pubescence. The nuts are an inch in length, narrow and elongated, and resemble those of *Quercus alba;* the cups are turbinate, entirely destitute of marginal fringe, coated with thick pale tomentum and covered with green triangular scales which, except that they are somewhat more thickened toward the base of the cup, resemble those of *Quercus macrocarpa*. Seedlings raised from acorns of this tree were planted in the Arnold Arboretum in 1880, and reproduce the foliage of the parent. Their winter-buds, which are acute, are often nearly half an inch in length, or longer than those of either of the supposed parents, and are covered with the light reddish brown scales scarious on the margins of *Quercus macrocarpa*, they are often accompanied, like those of this species, by the persistent stipules of the upper leaves. The trees grow much more rapidly than the specimens of *Quercus alba* and *Quercus macrocarpa* in the same plantation.

[4] On the grounds of Mr. John Saul, the horticulturist and nurseryman, two miles north of the city of Washington, Dr. George Vasey discovered a tree which appears intermediate between *Quercus alba* and *Quercus Prinus* (Plate ccclxi.). Saul's Oak is a tree about fifty feet high in a grove of Red and White Oaks and Chestnut-trees. The bark is said to combine the characters of its supposed parents. The buds are ovate, acute, and nearly a quarter of an inch long, with the pale brown scales scarious and slightly ciliate on the margins of *Quercus Prinus*. The leaves are elongated, slightly or considerably broader toward their apex, wedge-shaped or rounded at the narrow base, and pale and nearly glabrous on the lower surface, with six or seven pairs of long narrow acute, or on some individuals short broad and rounded lateral lobes. Some of the leaves, especially those from lower branches, are not distinguishable from the leaves of *Quercus Prinus*, while others, with their deep narrow sinuses, are more like those of *Quercus alba*. The fruit is long-pedunculate, resembling that of *Quercus Prinus* in size and shape, but the cup-scales are rather freer than they are in this species (Vasey, *l. c.* 25, t. 28).

Another tree, found by Dr. George Vasey near the Soldiers' Home in Washington in 1874, growing with *Quercus alba* and *Quercus Prinus*, and destroyed four years later, possessed some characters of both of its supposed parents. The slightly pubescent branchlets and the winter-buds were those of *Quercus Prinus*. The leaves, which were incisely lobed with oblique rounded lobes, were

The White Oak is one of the most valuable and important timber-trees of North America. The wood is strong, very heavy, hard, tough, close-grained, and durable in contact with the soil, although liable to check unless carefully seasoned. It contains broad conspicuous medullary rays and bands of several rows of large open ducts marking the layers of annual growth, and is light brown, with thin light brown sapwood. The specific gravity of the absolutely dry wood is 0.7470, a cubic foot weighing 46.35 pounds. It is employed in shipbuilding, for construction, in cooperage, large quantities being exported annually to Europe in the form of staves, in the manufacture of carriages, agricultural implements, and baskets, for the interior finish of houses, and in cabinet-making, and for railway ties and fences; it makes excellent fuel, and is largely used as fire-wood.

Although first described by Parkinson in 1640,[1] the White Oak, according to Aiton, was not introduced into English plantations until 1728.[2]

The great size that it attains in good soil, its vigor, longevity, and stately habit, the tender tints of its vernal leaves when the sunlight plays among them, the cheerfulness of its lustrous summer green and the splendor of its autumnal colors, make the White Oak one of the noblest and most beautiful trees of the American forest; and some of the venerable broad-branched individuals growing on the hills of New England and the middle states realize more than any other American tree, that ideal of strength and durability of which the Oak has been the symbol in all ages and all civilized countries.[3]

thick and firm, dark green and lustrous above, and pale and slightly pubescent below, with the broad rounded base often found on the leaves of *Quercus Prinus*, which, in their acute sinuses, they generally resembled. The fruit was sessile, with a short broad nut less than an inch in length, and distinct thickened cup-scales, with membranaceous triangular tips (Engelmann, *Trans. St. Louis Acad.* iii. 399).

Another tree, found by Dr. Vasey two miles north of the city of Washington and believed by him to be a hybrid between *Quercus alba* and *Quercus minor* (*Bull. Torrey Bot. Club*, x. 26, t. 30), has oblong rather narrow thick lustrous leaves slightly puberulous on the lower surface, broad and rounded at the base, and regularly and incisely lobed. The fruit, however, resembles that of *Quercus Prinus*, and, judging by herbarium specimens, this tree might be considered an extreme form of that species, possibly slightly influenced by a cross with *Quercus alba*.

A tree, found by Mr. C. G. Pringle in 1879 growing on a high dry rocky hill near Charlotte in northern Vermont, has characters intermediate between those of *Quercus alba* and *Quercus Prinus*. The leaves are obovate, wedge-shaped at the base, thick and firm, dark green and lustrous above, and pale and pubescent below, with six or eight pairs of narrow oblique rounded lobes. The fruit is short-pedunculate, with an ovate pointed acorn rather less than an inch in length and a shallow thin pubescent cup covered with regular triangular thickened scales. In its leaves this tree approaches *Quercus Prinus*, while in the fruit and buds it is more like *Quercus alba*.

[1] "They have in *Virginia* a goodly tall Oke, which they call the white Oke, because the barke is whiter then of others, whose leafe because it so neerely resembleth this sweete Oke, I have joined with it, the Ackorne likewise, is not onely sweeter then others, but by boyling it long, it giveth an oyle which they keepe to supple their joynts." (*Theatr.* 1387.)

Quercus alba Virginiana, Plukenet, *Alm. Bot.* 309. — Miller, *Dict.* No. 9. — Catesby, *Nat. Hist. Car.* i. 21, t. 21. — Charlevoix, *Histoire de la Nouvelle France*, ed. 12mo. iv. 339, f. 46. — Romans, *Nat. Hist. Florida*, 18.

Quercus foliis superne latoribus opposite sinuatis, sinubus angulisque obtusis, Clayton, *Fl. Virgin.* 117. — Romans, *Nat. Hist. Florida*, 26.

Quercus alba Banisteri, Duhamel, *Traité des Arbres*, ii. 203.

[2] *Hort. Kew.* iii. 358. — Loudon, *Arb. Brit.* iii. 1864, f. 1723, 1726, t.

[3] Dame & Brooks, *Typical Elms and other Trees of Massachusetts*, t. 45–47. — *Garden and Forest*, iii. 85, f.; iv. f. 1, 2.

EXPLANATION OF THE PLATES.

Plate CCCLVI. Quercus alba.

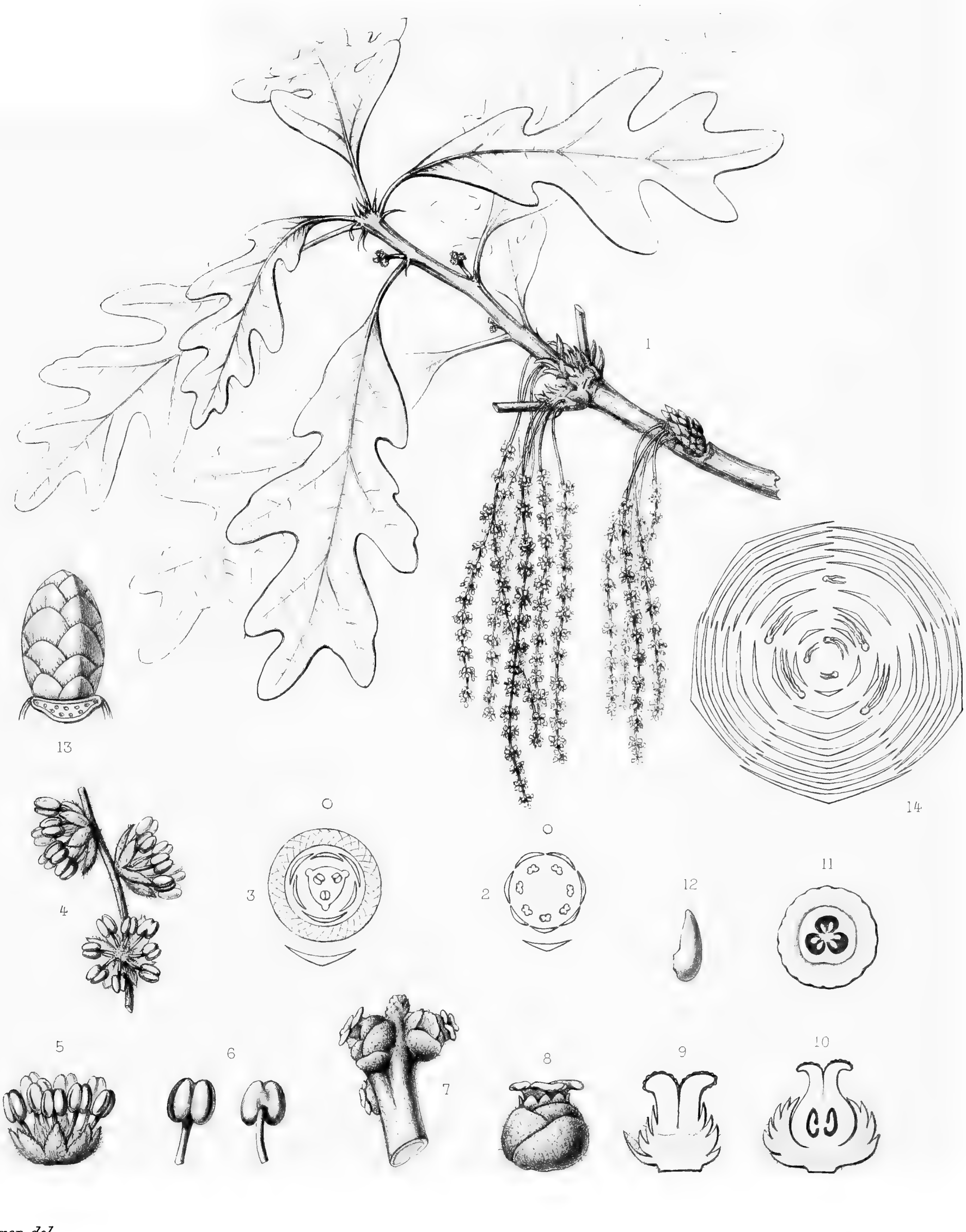
1. A flowering branch, natural size.
2. Diagram of a staminate flower.
3. Diagram of a pistillate flower.
4. Portion of an ament of staminate flowers, enlarged.
5. A staminate flower, enlarged.
6. A stamen, front and rear views, enlarged.
7. A cluster of pistillate flowers, enlarged.
8. A pistillate flower, enlarged.
9. Vertical section of a pistillate flower before fecundation, enlarged.
10. Vertical section of a pistillate flower after fecundation, enlarged.
11. Cross section of an ovary after fecundation, enlarged.
12. An ovule, much magnified.
13. An axillary winter-bud and leaf-scar, enlarged.
14. Diagram of a leaf-bud.

Plate CCCLVII. Quercus alba.

1. A fruiting branch, natural size.
2. A nut, basal view, natural size.
3. A cup, natural size.
4. A cup-scale, enlarged.
5. Vertical section of a nut, natural size.
6. A seed, natural size.
7. A germinating nut, natural size.
8. A winter branchlet, natural size.

Plate CCCLVIII. Quercus alba.

1. A fruiting branch of a tree with pinnatifid leaves and long-pedunculate fruit, natural size.



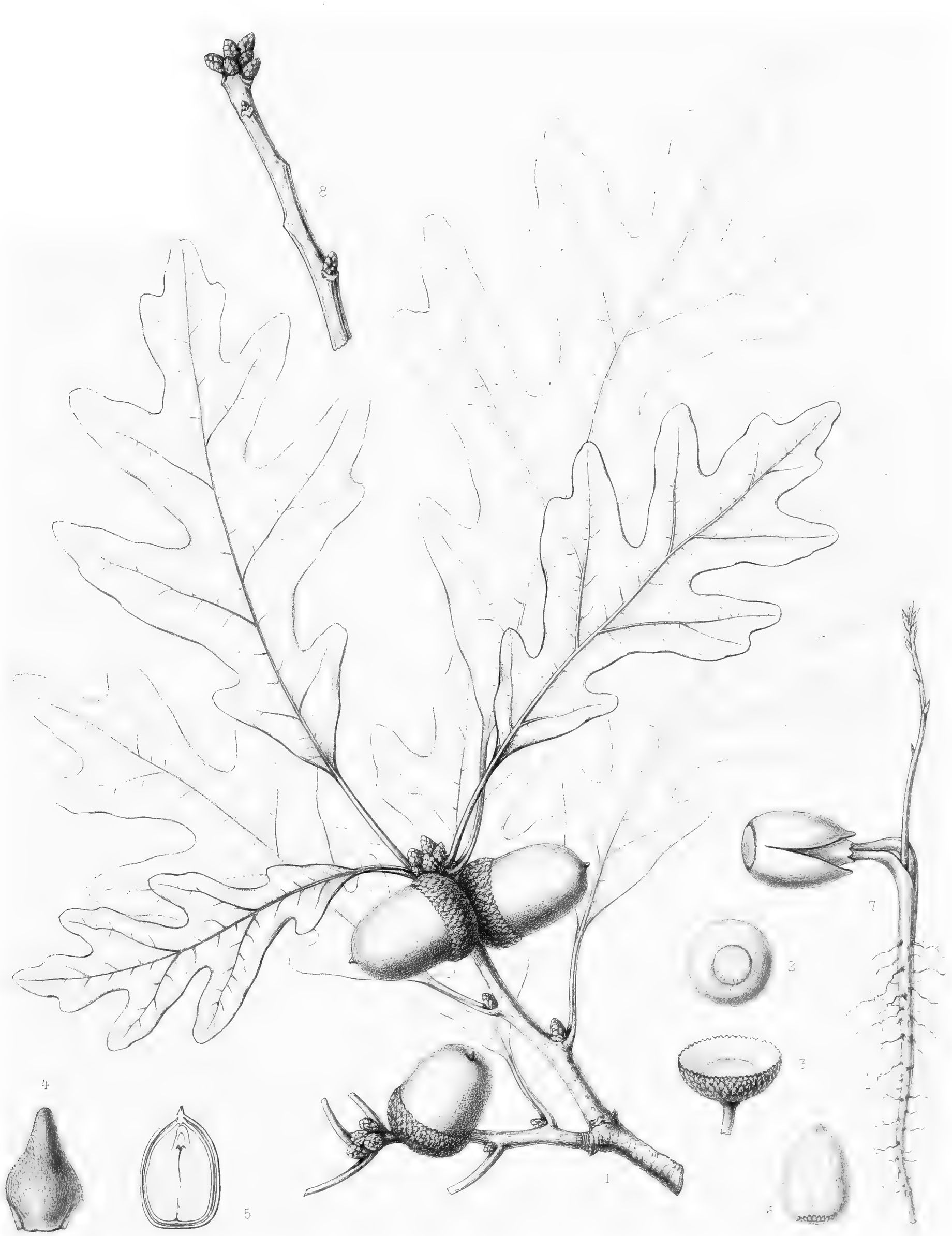
C.E. Faxon del.

Rapine sc.

QUERCUS ALBA, L.

A. Riocreux direx.t

Imp. J. Taneur, Paris.



C.E.Faxon del. *Rapine sc.*

QUERCUS ALBA, L.

A.Riocreux direx.t *Imp.J Taneur, Paris.*

C.E.Faxon del. Himely sc

QUERCUS ALBA, L.

A.Riocreux direx.t. Imp. J.Taneur, Paris

EXPLANATION OF THE PLATES.

PLATE CCCLIX. QUERCUS ALBA × MINOR.

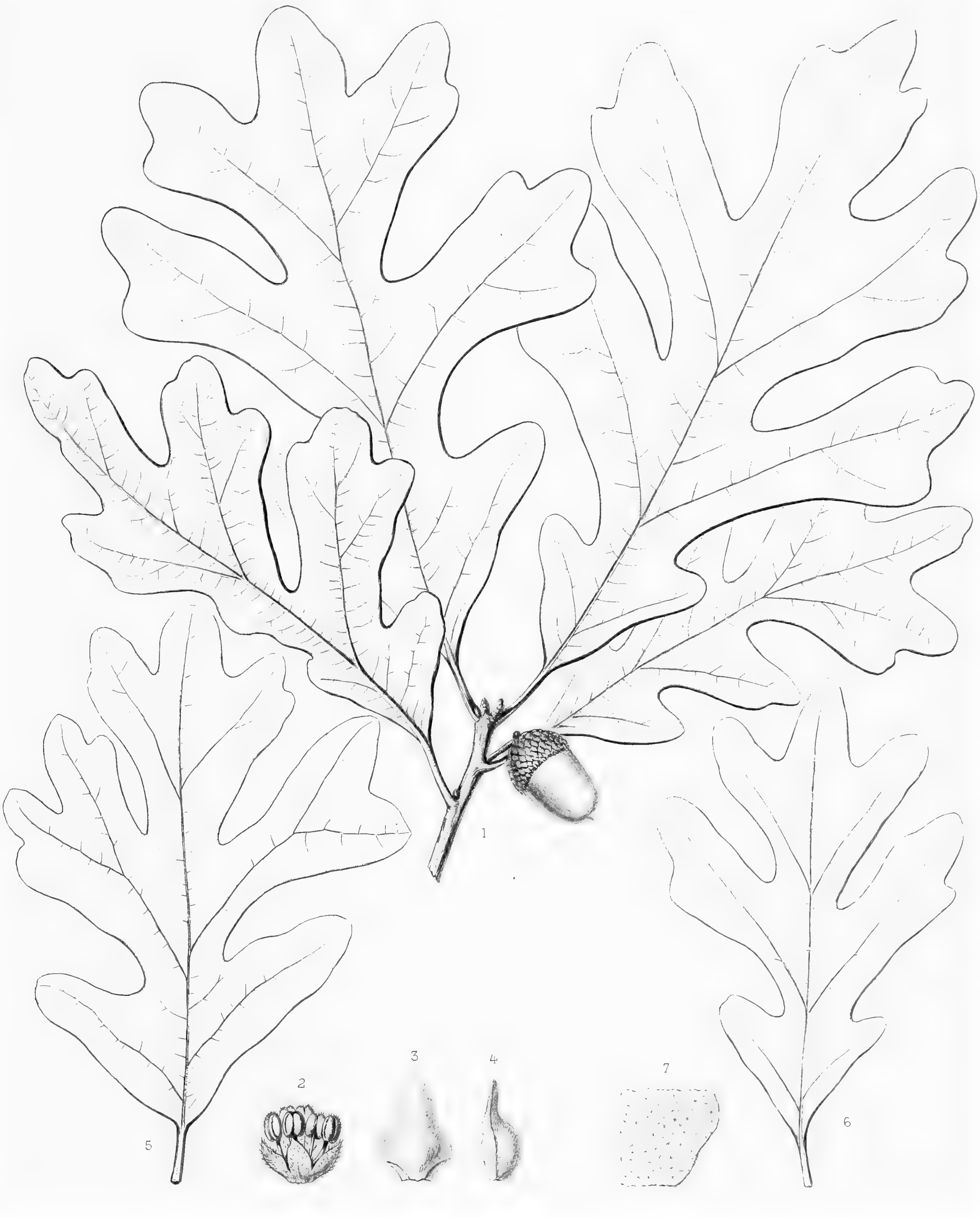
1. A fruiting branch, natural size.
2. A staminate flower, enlarged.
3. A cup-scale, outer surface, enlarged.
4. A cup-scale, side view, enlarged.
5. A leaf, enlarged.
6. A leaf, enlarged.
7. Upper surface of a portion of a mature leaf showing stellate pubescence, enlarged.

PLATE CCCLX. QUERCUS ALBA × MACROCARPA.

1. A fruiting branch, natural size.

PLATE CCCLXI. QUERCUS ALBA × PRINUS.

1. A fruiting branch, natural size.



C.E. Faxon del.

Monziés sc.

QUERCUS ALBA x MINOR.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

C E Faxon del. Himely sc.

QUERCUS ALBA x MACROCARPA

A Riocreux dirext Imp. J. Taneur, Paris.

C.E. Faxon del. Himely sc

QUERCUS ALBA X PRINUS

A. Riocreux direx.t Imp J. Taneur, Paris

QUERCUS LOBATA.

White Oak. Valley Oak.

LEAVES oblong or obovate, deeply lobed, pale and pubescent below.

Quercus lobata, Née, *Anal. Cienc. Nat.* iii. 277 (*Descripcion de varias Especies nuevas de Encina*) (1801). — Persoon, *Syn.* ii. 570. — *Nouveau Duhamel*, vii. 180. — Poiret, *Lam. Dict.* Suppl. ii. 224. — Bentham, *Pl. Hartweg.* 337. — Liebmann, *Oversigt Dansk. Vidensk. Selsk. Forhandl.* 1854, 172. — Torrey, *Bot. Mex. Bound. Surv.* 205; *Bot. Wilkes Explor. Exped.* 461, t. 15. — R. Brown Campst. *Horæ Sylvanæ*, 52, f. 1–3. — A. de Candolle, *Prodr.* xvi. pt. ii. 24. — Bolander, *Proc. Cal. Acad.* iii. 230. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 66; *Liebmann Chênes Am. Trop.* 23, t. 42, f. 1–3. — Koch, *Dendr.* ii. pt. ii. 53. — Engelmann, *Trans. St. Louis Acad.* iii. 388; *Rothrock Wheeler's Rep.* vi. 374; *Brewer & Watson Bot. Cal.* ii. 95. — Kellogg, *Forest Trees of California*, 66. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 138. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 188. — Greene, *West Am. Oaks*, 13, t. 8; *Man. Bot. Bay Region*, 302; *Erythea*, ii. 64. — Mayr, *Wald. Nordam.* 264, t. 2. — Dippel, *Handb. Laubholzk.* ii. 75. — Coville, *Contrib. U. S. Nat. Herb.* iv. 197 (*Bot. Death Valley Exped.*).

Quercus Hindsii, Bentham, *Bot. Voy. Sulphur*, 55 (1844). — Endlicher, *Gen.* Suppl. pt. iv. 24. — Walpers, *Ann.* i. 635. — Torrey, *Pacific R. R. Rep.* iv. 138. — Newberry, *Pacific R. R. Rep.* vi. 29, 89, t. 1, f. 7. — Örsted, *Liebmann Chênes Am. Trop.* t. 42, f. 4.

Quercus longiglanda, Frémont, *Geographical Memoir upon Upper California*, 15, 17 (*Senate Doc. Miscellaneous*, No. 148, 30th Congress U. S. 1st Sess.) (1848).

Quercus lobata, var. **Hindsii**, Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 188 (1885).

The largest and most graceful of the Oaks of Pacific North America, *Quercus lobata* often rises to a height of one hundred feet. The trunk is generally three or four feet, but sometimes ten feet in diameter, and dividing near the ground, or usually twenty or thirty feet above it, into great limbs spreading at wide and varied angles, forms a broad head of slender branches which, hanging gracefully in long sprays, sometimes sweep the ground and cover a space from one to two hundred feet across.[1] Less frequently the upper limbs grow almost at right angles with the trunk and form a narrow and more rigid head of variously contorted erect or pendent branches. The bark of the trunk and large limbs is usually from three quarters of an inch to an inch and a half in thickness, and is covered with small loosely appressed light gray scales slightly tinged with orange or brown; at the base of old trees it is frequently five or six inches in thickness and is divided by longitudinal shallow fissures into broad flat ridges broken horizontally into short plates. The branchlets are slender and are marked with oblong pale scattered lenticels, and when they first appear are coated, as are the young leaves and petioles, with short silky canescent pubescence; in the first winter they are ashy gray, light reddish brown or pale orange-color, and slightly pubescent, or puberulous, becoming glabrous and lighter colored during their second year. The buds are ovate, acute, and usually about a quarter of an inch long, but often smaller, with orange-brown pubescent scales scarious and frequently ciliate on the margins. The leaves, which are very variable in shape on the same branch, are conduplicate in vernation, and are gradually narrowed and wedge-shaped or broad and rounded or cordate at the base; the sinuses which divide them slightly or nearly to the midribs are rounded, acute, or oblique at the base, and although irregular in width are generally narrow except near the middle of the leaf, where one or two pairs are often much wider than the others; the terminal lobe is broad, obovate or oblong, and somewhat three-lobed or entire at the rounded apex; the three to five pairs of oblique lateral lobes diminish in size from the uppermost to the lowest, which are usually not more than half as long as those of the next pair above them and are generally acute and entire; the other lobes are obovate, obtuse or retuse, or rarely lobed-dentate at their broad apex, or are sometimes ovate and rounded; or occasionally the

[1] *Garden and Forest*, iii. 606, f.

leaves are undulately or crenately toothed; they are thin but firm in texture, deciduous, from two and a half to three inches or rarely four inches long, from an inch to two inches broad, dark green and stellate-pubescent on the upper surface, and pale and pubescent on the lower, with stout pale midribs, conspicuous yellow veins running to the slightly thickened and revolute margins, obscure lateral veins and veinlets, and broad hirsute flattened petioles varying from a quarter to a half of an inch in length. The aments of staminate flowers, which appear when the leaves are about half grown, from February at the south to the end of April at the north, are hirsute and from two to three inches in length; the calyx is light yellow and divided into six or eight acute lobes which are pubescent on the outer surface and ciliate on the margins; the stamens equal the calyx-lobes in number, and the yellow anthers are emarginate and glabrous. The pistillate flowers are solitary and sessile, or rarely are borne in elongated few-flowered spikes; the scales of the involucre are broadly ovate, acute, coated with dense pale tomentum, and about as long as the narrow calyx-lobes. The acorns are solitary or often in pairs, and sessile or subsessile; the nut is conical, elongated, and rounded or pointed at the apex, which is covered with persistent fine white pubescence and tipped with a short thick umbo; it varies from an inch and a quarter to two inches and a quarter in length, and is bright green and lustrous when fully grown, ultimately turning bright chestnut brown; the cup, which varies from a quarter of an inch to nearly an inch in depth, is cup-shaped or rarely saucer-shaped, coated within and without with pale tomentum, and usually irregularly tuberculate below by the large thickened scales; these decrease upward in size and thickness, and, with the exception of those at the base of the cup, are elongated into acute ciliate chestnut-brown free tips which are longest on the uppermost scales, forming a short fringe-like border to the edge of the cup.

Quercus lobata inhabits the valleys of western California between the Sierra Nevada and the ocean, from that of the upper Sacramento to the Tejon Pass, where it crosses the coast ranges into Antelope Valley, and to Santa Monica on the seacoast.[1] Never forming a dense forest, the California White Oak, either alone or with the Blue Oak, covers with open groves free of all shrubby undergrowth the central valleys of the state. Since the eyes of the white man first looked upon these natural parks, which surpassed in grandeur of broad effect and in the dignity of their graceful trees all the creations of the landscape gardener's art, fields of wheat have replaced the wild grasses which covered their open glades, and many of their noblest trees have been sacrificed to satisfy the demands of civilization. No other region in North America, however, presents to-day anything that compares with their park-like beauty, the nobility of their individual trees, or the charm of the long vistas stretching beneath them.

The wood of *Quercus lobata* is moderately hard, fine-grained, brittle, and difficult to season. It contains bands of large open ducts marking the layers of annual growth, and smaller ducts arranged in lines parallel with the broad conspicuous medullary rays, and is light brown, with thin lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.7409, a cubic foot weighing 46.17 pounds. Of little economic value, it is used only for fuel.

The nuts, which *Quercus lobata* produces in great profusion, were gathered and stored for winter use by the California Indians, who pounded them into coarse flour, which they mixed with water and baked or steamed in rude ovens dug in the sand.[2]

In March, 1792, Vancouver anchored in the Bay of San Francisco, and visited the Spanish Mission of Santa Clara situated in a beautiful valley which reminded him of England; and the earliest account of the California White Oak appears in his narrative of this journey.[3] A year earlier, the Spanish

[1] Merriam, *North American Fauna*, No. 7, pt. ii. 333 (*Death Valley Exped.* ii.). — S. B. Parish, *Zoë*, iv. 345.

[2] Newberry, *Popular Science Monthly*, xxxii. 37 (*Food and Fibre Plants of the North American Indians*).

[3] "We had not proceeded far from this delightful spot, when we entered a country I little expected to find in these regions. For about twenty miles it could only be compared to a park, which had originally been closely planted with the true old English Oak; the underwood, that had probably attended its early growth, had the appearance of having been cleared away, and had left the stately lords of the forest in complete possession of the soil, which was covered with luxuriant herbage, and beautifully diversified with pleasing eminences and vallies; which, with the range of lofty rugged mountains that bounded the prospect, required only to be

exploring expedition, under the command of Malaspina, had visited the coast of California, and the French botanist, Louis Née,[1] who accompanied it, published in 1801 the first scientific description of *Quercus lobata* and of several other Californian and Mexican Oaks.

Like other California Oaks, *Quercus lobata* does not flourish beyond the borders of its native state, and the attempts that have been made to establish it in eastern America and in Europe have not been successful.

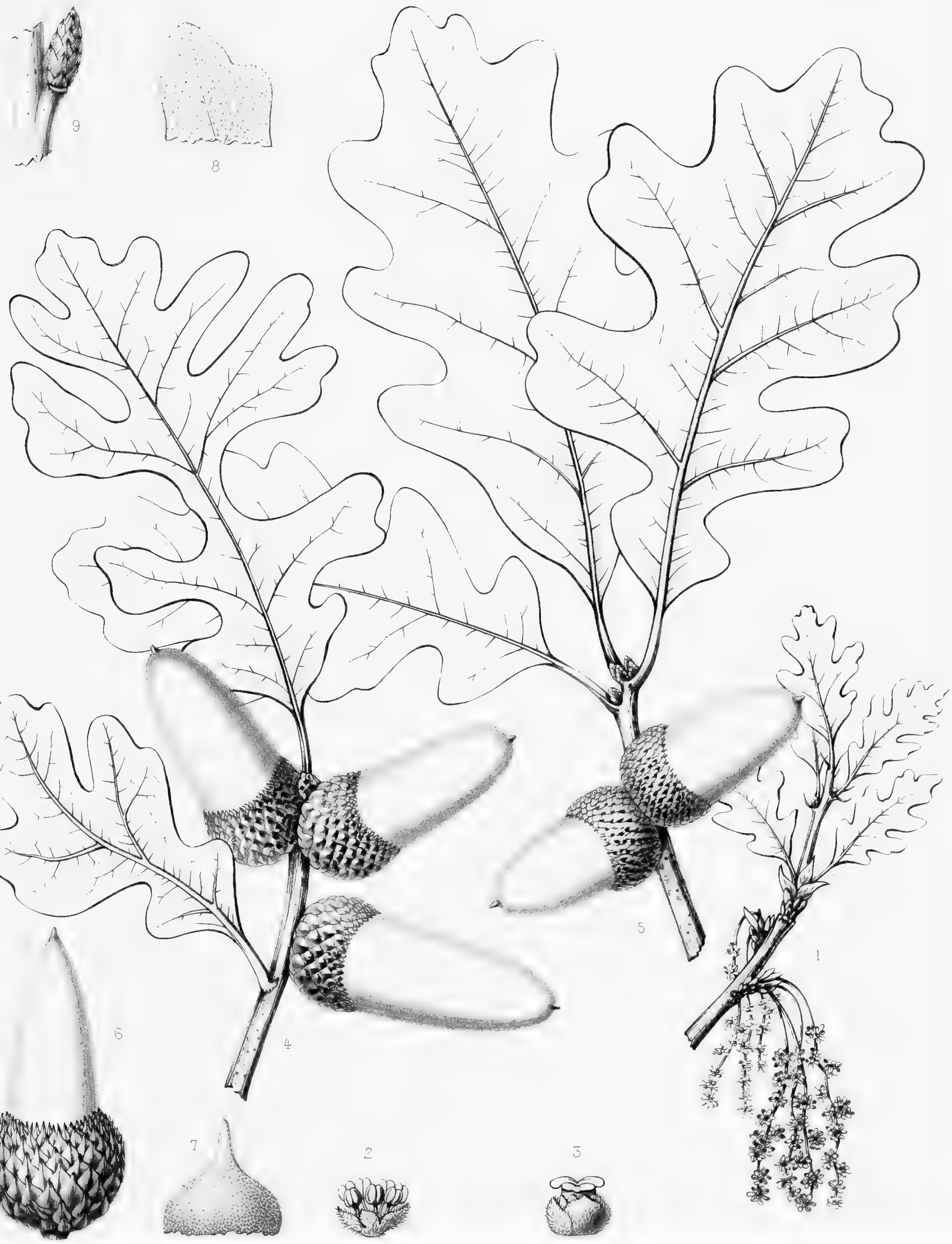
adorned with the neat habitations of an industrious people, to produce a scene not inferior to the most studied effect of taste in the disposal of grounds." (*A Voyage of Discovery round the World*, ii. 17.)

[1] Louis Née, a Frenchman naturalized in Spain, began his scientific career by making large collections of plants in different parts of that country; and in July, 1789, he left Cadiz as naturalist of the exploring expedition sent by the Spanish government under command of Malaspina. Née made collections of plants in the neighborhood of Montevideo, on the coast of Patagonia, on the Island of Chiloe, in Chile, — where he was joined by the Bohemian botanist, Thaddaeus Haenke, — Peru, Mexico, and California. In Mexico, the botanists penetrated inland to the capital, and then returning to the coast, sailed with the expedition to the Philippine Islands and New Holland. Sailing again to South America, they finally left the ship at Callao, and going to Lima, separated there. Née then traveled through Chile, crossed the pampas to Montevideo, and embarked for Spain, reaching Cadiz in 1794 with an herbarium of ten thousand species, of which four thousand are believed to have been undescribed. Née's tastes led him to gather material rather than to publish the results of his field labors, and his long journey had few literary results. He is chiefly to be remembered by the genus *Neea*, dedicated to him by Ruiz and Pavon, by a few short papers published in the annals of the Scientific Society of Madrid, including one on Oaks, in which are the first scientific descriptions of California trees, and by the fact that he and Haenke were the first botanists who visited California. Of the date and place of Née's birth there is no record, and nothing has been published about his career after his return to Europe from his journey in America. His herbarium is preserved in the Botanic Garden at Madrid. (See Colmeiro, *La Botanica y los Botanicos de la Peninsula Hispano-Lusitano*, 183.)

EXPLANATION OF THE PLATE.

PLATE CCCLXII. QUERCUS LOBATA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A fruiting branch, natural size.
6. A fruit, natural size.
7. A cup-scale, enlarged.
8. Upper surface of a portion of a mature leaf showing the stellate pubescence, enlarged.
9. A winter-bud, enlarged.



C.E. Faxon del. *Toulet sc.*

QUERCUS LOBATA, Née.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

QUERCUS BREWERI.

Shin Oak.

LEAVES oblong, mostly acutely lobed, stellate-pubescent at maturity on the upper surface.

Quercus Breweri, Engelmann, *Brewer & Watson Bot. Cal.* ii. 96 (1880). — Coville, *Contrib. U. S. Nat. Herb.* iv. 196 (*Bot. Death Valley Exped.*).

Quercus lobata, subspec. **fruticosa**, Engelmann, *Trans. St. Louis Acad.* iii. 389 (1877).

Quercus lobata, var. **Breweri**, Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 188 (1885).

? **Quercus Œrstediana**, Greene, *West Am. Oaks*, 19, t. 10 (in part) (probably not of R. Brown Campst.) (1889).

A shrub, with slender stems and ashy gray bark, usually five or six, or occasionally fifteen or twenty feet high, spreading into broad compact thickets by stoloniferous roots. The branchlets are slender and marked with pale lenticels; when they first appear they are light green and clothed with loose pale tomentum, and during their first winter are light reddish brown or rather bright orange-color and coated with fine pubescence, which does not entirely wear off until their second or third year. The winter-buds are ovate, rather obtuse, and an eighth of an inch long, and are covered with chestnut-brown scales coated with pale pubescence. The leaves are convolute in the bud, oblong, abruptly or gradually narrowed and wedge-shaped, rounded or cordate at the base, rounded or acute at the apex, and mostly seven or occasionally nine-lobed, with broad acute or rounded and usually apiculate lobes; when they unfold they are clothed, especially below, with thick pale pubescence, and at maturity are thick and firm, dark green and lustrous on the upper surface, which is roughened with scattered stellate hairs, paler and pubescent on the lower surface, from one to four inches long and from half an inch to an inch and a quarter broad, with stout pale hirsute midribs and primary veins, obscure veinlets, and hairy terete petioles gradually enlarged toward the base and from a quarter to a half of an inch in length. The stipules are brown and scarious, covered with long pale hairs, and nearly an inch long. In October the leaves turn a bright clear yellow before falling. The flowers appear toward the middle of May, usually when the leaves are about one fourth grown, and are borne the males in short hirsute aments, the females sessile or on short stalks. The calyx of the staminate flower is clothed with pale hairs, and is deeply divided into from five to seven acute lobes shorter than the stamens, which are composed of slender filaments, and ovate, slightly emarginate, yellow glabrous anthers. The involucral scales and the calyx-lobes of the pistillate flower are coated with pale tomentum, and the stigmas are bright red. The fruit, which ripens in the autumn, is sessile or subsessile and usually solitary; the nut is ovate or oval, from an inch to an inch and a quarter in length and from three quarters of an inch to nearly an inch in breadth, and is inclosed only at the base by the shallow cup; this is cup-shaped or turbinate, pubescent on the inner surface, coated on the outer with pale or ferrugineous tomentum, and covered by broadly ovate scales which are gradually narrowed into long lanceolate acute membranaceous tips, and at the base of the cup are slightly thickened on the back, gradually decreasing in size toward the rim.

Quercus Breweri inhabits the western slopes of the Sierra Nevada in California, and ranges from the northern borders of the state to the valley of the upper Kaweah River in Tulare County, forming on the upper San Joaquin, at an elevation of about six thousand feet above the sea, vast, almost impenetrable thickets, with slender stems from twelve to eighteen feet in height, and, for miles, standing as regular as the plants in an evenly sown field of wheat.

Quercus Breweri was discovered in August, 1862, by Professor William H. Brewer,[1] growing on the top of a dry ridge a few miles west of Mount Shasta in northern California.

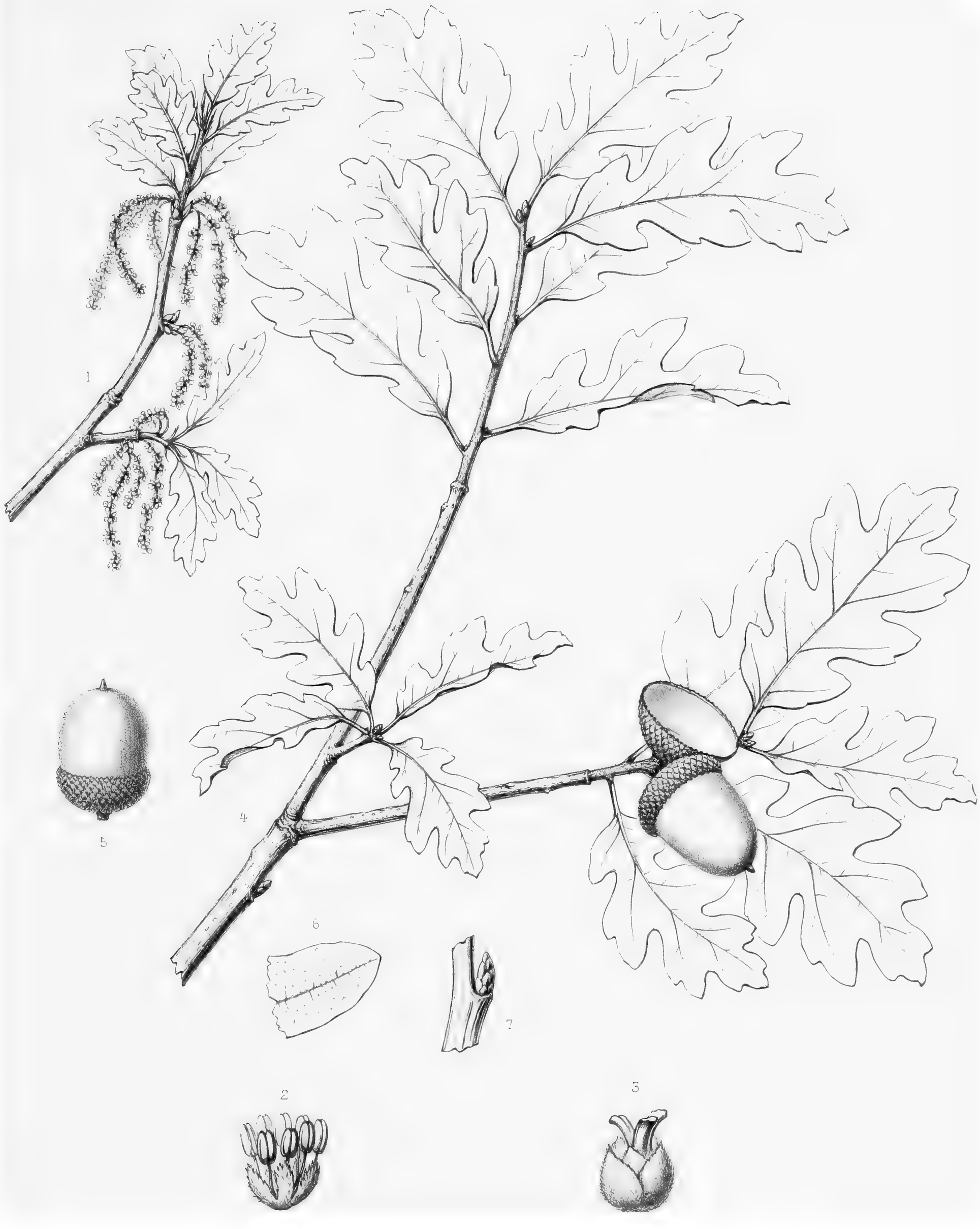
[1] William Henry Brewer, of French Huguenot and Dutch descent, was born in Poughkeepsie, New York, on September 14, 1828, and in infancy was taken to Enfield in the central part of the state, his parents settling there upon a farm where his childhood and youth were passed. In 1848 he entered the Scientific School of Yale College, from which he was graduated four years later. Beginning to teach in academies in 1850, while still a college student, he continued to do so in central New York until 1858, with the exception of two years which he passed in Germany and France studying botany and chemistry. In 1858 he was appointed professor in Washington College at Washington, Pennsylvania; but two years later, having received the appointment of first assistant in the newly organized California State Geological Survey, Professor Brewer went to California, where he remained for four years in charge of the field work of the survey. During this period he traveled all over the state, and made large and important collections of plants, with copious field-notes; and the first comprehensive and accurate knowledge with regard to the distribution and the scientific and economic characters of California trees was obtained from his field observations. In 1864 he was appointed to the chair of agriculture in the Sheffield Scientific School at Yale College, which he still occupies. In 1865 Professor Brewer began in the Gray Herbarium at Cambridge the preparation of a Flora of California, and in 1874 his friends in that state raised a sum of money to cover the expenses of this publication. The first volume appeared in 1876, the Polypetalæ being principally described by Professor Brewer and the Gamopetalæ by Asa Gray. The second volume, from the pen of Sereno Watson and other botanists, was published in 1880.

Since his connection with the Sheffield Scientific School, Professor Brewer has exerted a wide influence by his lectures on agricultural science and his papers on many scientific subjects published in periodicals and in the proceedings of scientific societies. The genus *Brewerina* from the California mountains, now united with Arenaria, was established by Gray to commemorate Professor Brewer's important services in elucidating the flora of that state. One of the high peaks of the Sierra Nevada, the remotest fastnesses of which he explored, climbing all the high summits and crossing and recrossing all the passes, bears his name, which is also associated with a beautiful Spruce-tree of the California mountain forests.

EXPLANATION OF THE PLATE.

PLATE CCCLXIII. QUERCUS BREWERI.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A fruit, natural size.
6. Upper surface of a portion of a mature leaf showing stellate pubescence, enlarged.
7. A winter-bud, enlarged.



C.E.Faxon del. *Rapine sc.*

QUERCUS BREWERI, Engelm.

A.Riocreux direx.t *Imp.J.Taneur, Paris.*

QUERCUS GARRYANA.

White Oak.

LEAVES obovate or oblong, coarsely pinnatifid lobed.

Quercus Garryana, Hooker, *Fl. Bor.-Am.* ii. 159 (1839). — Hooker & Arnott, *Bot. Voy. Beechey*, 391. — Nuttall, *Sylva*, i. 1, t. 1. — Dietrich, *Syn.* v. 309. — Torrey, *Pacific R. R. Rep.* iv. 138; *Bot. Wilkes Explor. Exped.* 462. — Newberry, *Pacific R. R. Rep.* vi. 89. — Cooper, *Pacific R. R. Rep.* xii. pt. ii. 28, 68; *Am. Nat.* iii. 407. — R. Brown Campst. *Horæ Sylvanæ*, 60. — Lyall, *Jour. Linn. Soc.* vii. 131, 144. — A. de Candolle, *Prodr.* xvi. pt. ii. 24. — Bolander, *Proc. Cal. Acad.* iii. 229. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 66; *Liebmann Chênes Am. Trop.* t. 40, f. 3. — Rothrock, *Smithsonian Rep.* 1867, 435 (*Fl. Alaska*). — Engelmann, *Trans. St. Louis Acad.* iii. 389; *Brewer & Watson Bot. Cal.* ii. 95. — Kellogg, *Forest Trees of California*, 89. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 138. — Greene, *West Am. Oaks*, 11, t. 7; *Man. Bot. Bay Region*, 302. — Mayr, *Wald. Nordam.* 281, t. 2, 5. — Lloyd, *Garden and Forest*, vii. 494, f. 78.

Quercus Neæi, Liebmann, *Oversigt Dansk. Vidensk. Selsk. Forhandl.* 1854, 173. — Örsted, *Liebmann Chênes Am. Trop.* 23, t. 41, f. 1, 2.

Quercus Douglasii, δ? Neæi, A. de Candolle, *Prodr.* xvi. pt. ii. 24 (1864).

? **Quercus Œrstediana**, R. Brown Campst. *Ann. and Mag. Nat. Hist.* ser. 4, vii. 250 (1871). — Greene, *West Am. Oaks*, t. 10 (in part).

Quercus Jacobi, R. Brown Campst. *Ann. and Mag. Nat. Hist.* ser. 4, vii. 255 (1871). — Greene, *West Am. Oaks*, 75, t. 35, 36, f. 1.

Quercus Gilberti, Greene, *West Am. Oaks*, pt. ii. 77, t. 37 (1890).

A tree, with an average height of sixty or seventy feet, but sometimes growing nearly one hundred feet tall, with a trunk two or three feet in diameter, and stout ascending or spreading branches which form a broad compact head; or frequently at high elevations, or when it is exposed to the direct winds from the ocean, reduced to a low shrub.[1] The bark of the trunk varies from an eighth of an inch to nearly an inch in thickness; it is divided by shallow fissures into broad ridges, and separates on the surface into light brown or gray scales sometimes slightly tinged with orange-color. The branchlets, which are stout and marked with many conspicuous pale lenticels, are coated at first with thick pale rufous pubescence, and during their first winter are pubescent or tomentose and light or dark orange-color, becoming glabrous and rather bright reddish brown in their second year, and ultimately gray. The winter-buds are ovate, acute, and from one third to one half of an inch in length, and are densely clothed with light ferrugineous tomentum. The leaves are convolute in the bud, oblong-obovate and wedge-shaped or rounded at the base, with slightly thickened revolute margins, and are divided by shallow sinuses into seven or nine lobes, the terminal lobe being rounded and acute or three-lobed at the apex, and the lateral lobes, which increase in size from the bottom of the leaf upwards, being acute or sometimes apiculate or rounded and often notched or lobed; when they unfold they are coated with soft pale lustrous pubescence, and at maturity they are thick and firm or subcoriaceous, dark green, lustrous and glabrous on the upper surface, light green or orange-brown, pubescent, or glabrate in some shrubby forms, on the lower surface, from four to six inches long and from two to five inches broad, with stout light yellow midribs and conspicuous primary veins spreading at wide angles or gradually diverging from the midrib and running to the points of the upper lobes;[2] they are borne

[1] On the shores of Puget Sound and on some of its islands what is evidently a depauperate form of this species is not uncommon, its low stems composing dense thickets from two to six feet in diameter and a few feet in height. The leaves are thin, pale on the lower surface, and acutely lobed, the usually divided lobes terminating in minute rigid points. The branchlets and winter-buds are not distinguishable from those of *Quercus Garryana*. These shrubs do not appear to produce flowers or fruit. On one of their sterile shoots, *Quercus Gilberti* was established.

[2] The spreading of the primary veins at narrow angles from the midrib, which often occurs in individual leaves of *Quercus Garryana* (Plate ccclxv. f. 2), as it does in those of many other Oak-trees, and is particularly noticeable in the leaves of *Quercus Gambelii* of the interior of the continent, has been used in connection with the digi-

on stout pubescent petioles flattened on the upper side and from half an inch to nearly an inch in length, and before falling in the autumn sometimes turn a bright scarlet. The stipules are linear-lanceolate, coated with dense tomentum, from half an inch to an inch in length and usually caducous, those of the upper leaves, however, sometimes remaining on the branch throughout the season. The staminate flowers are produced in hirsute aments; their calyx-lobes are glabrous, laciniately cut, slightly ciliate on the margins with soft fine hairs, ovate-acute and but little longer than the stamens, with emarginate glabrous yellow anthers, or sometimes linear-lanceolate and much elongated. The pistillate flowers are sessile or short-pedunculate, and are coated with pale tomentum. The fruit is sessile or short-stalked, with an oval or slightly obovate obtuse sweet nut from an inch to an inch and a quarter in length and from half an inch to nearly an inch in breadth; the cup is shallow, cup-shaped or slightly turbinate, puberulous and light brown on the inner surface, and pubescent or tomentose on the outer; the scales are ovate-acute, with acute and often elongated tips; they are thin and free, or sometimes thickened and more or less united toward the base of the cup, and, gradually decreasing in size from below upward, are minute at the rim.[1]

Quercus Garryana usually inhabits valleys and the dry and gravelly slopes of low hills, and is distributed from the southern part of Vancouver's Island and the valley of the lower Frazer River[2] southward through western Washington and Oregon and the California coast-valleys to the Santa Cruz Mountains. Rare and local in British Columbia, where it is the only Oak-tree, *Quercus Garryana* is abundant and grows to its largest size in the valleys of western Washington and Oregon, ascending in shrubby forms to considerable elevations on the western slopes of the Cascade Mountains, and occasionally reappearing on their eastern slopes, where it is common in the valley of the Yakima River. It is abundant in northwestern California, gradually becoming less frequent and of smaller size southward, and in the neighborhood of the Bay of San Francisco is exceedingly rare.

As a timber-tree, *Quercus Garryana* is the most important Oak of Pacific North America. The wood is strong, hard, and close-grained, and that from young trees is frequently exceedingly tough and valuable. It contains numerous and often conspicuous medullary rays and bands of from one to three rows of open ducts marking the layers of annual growth. It is light brown or yellow, with thin nearly white sapwood. The specific gravity of the absolutely dry wood is 0.7453, a cubic foot weighing 46.45 pounds. In Oregon and Washington it is used in the manufacture of carriages and wagons, in cabinet-making and shipbuilding, and in cooperage, and is also largely consumed as fuel.

Quercus Garryana was discovered on the shores of Puget Sound by Archibald Menzies,[3] the surgeon and naturalist of Vancouver, during his voyage of discovery at the end of the last century, although no account of it was published until after its rediscovery near the Columbia River many years later by David Douglas,[4] who named it in honor of Nicholas Garry, secretary of the Hudson's Bay Company, by whom he was aided in his explorations in western America.

tate lobing of such leaves at the apex as the principal character for distinguishing *Quercus Jacobi*. In specimens, however, taken by Professor Macoun from the tree in Vancouver upon which this species was founded, the subpalmate venation does not appear, the veins leaving the midrib at comparatively broad angles; and on the same individual tree leaves with both systems of veining can often be found (Plate cccIxv. f. 1, from a specimen from the type tree of *Quercus Jacobi*).

[1] On dry hillsides in the Klamath valley of northern California, at an elevation of twenty-five hundred feet above the level of the sea, what appears to be a dwarf form of this species (Plate cccIxv. f. 3) is very abundant, growing to a height of six or ten feet and producing fruit in the greatest profusion. The buds and branches and their pubescence are not distinguishable from those of *Quercus Garryana*. The leaves, although rather smaller than those produced on vigorous trees of this species, are otherwise similar. The flowers are unknown; and the fruit is peculiar only in the thicker and more tuberculate scales at the base of the cup. This is probably the *Quercus Œrstediana* of R. Brown Campst., who found it in September, 1865, in southern Oregon. Unfortunately, however, the specimens upon which *Quercus Œrstediana* were established have not been preserved, and his account of this species excites some doubt whether the author described this dwarf form of *Quercus Garryana* or *Quercus Breweri*. These two plants appear to have been figured in Greene's *West Am. Oaks* as *Quercus Œrstediana*.

[2] George M. Dawson, *Canadian Naturalist*, n. ser. ix. 330.—Macoun, *Cat. Can. Pl.* 440; pt. v. 355.

[3] See ii. 90.

[4] See ii. 94.

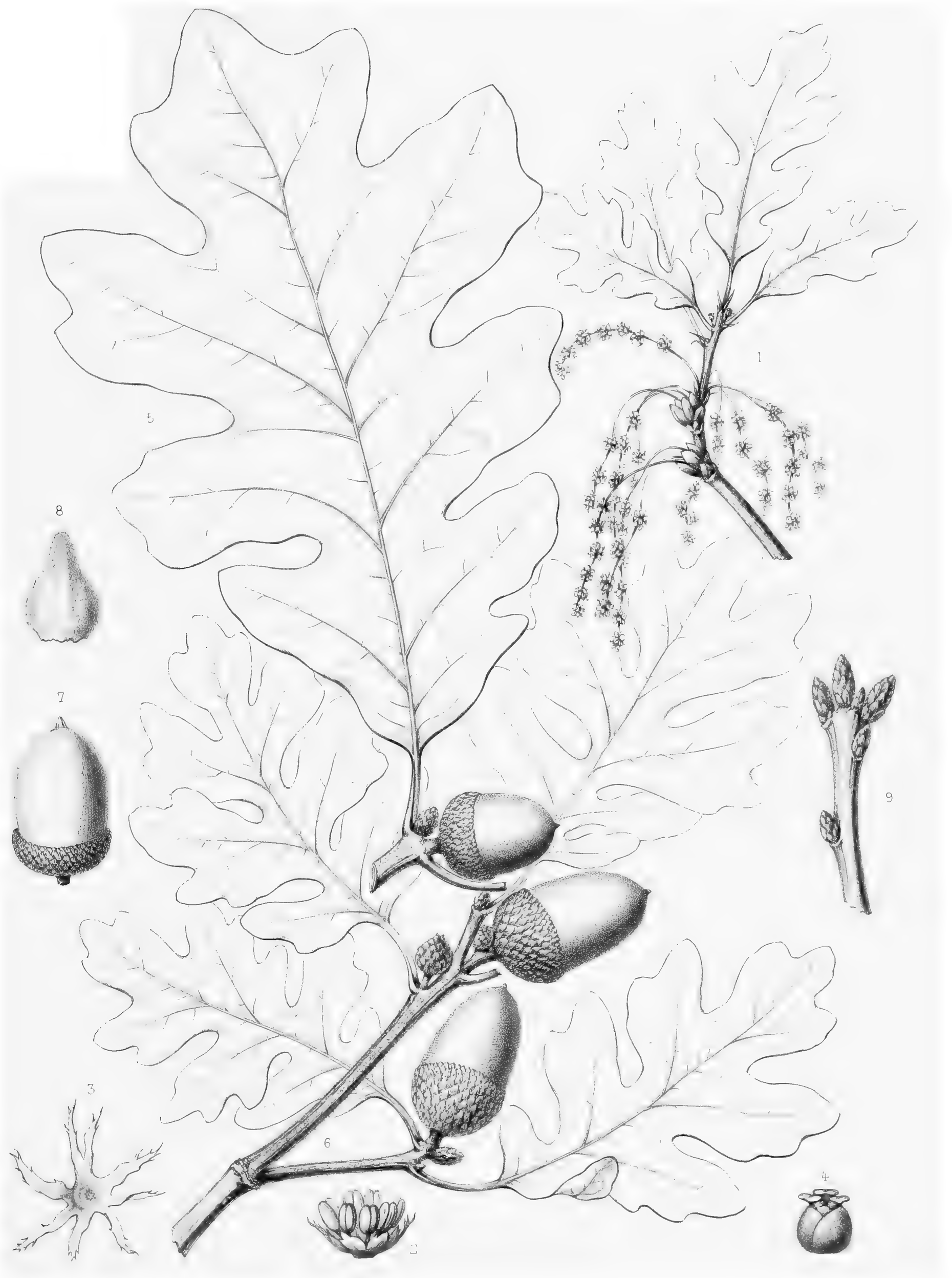
EXPLANATION OF THE PLATES.

PLATE CCCLXIV. QUERCUS GARRYANA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. Calyx of a staminate flower, enlarged.
4. A pistillate flower, enlarged.
5. A fruiting branch, natural size.
6. A fruiting branch, natural size.
7. A fruit, natural size.
8. A cup-scale, enlarged.
9. A winter branchlet, natural size.

PLATE CCCLXV. QUERCUS GARRYANA.

1. A fruiting branch, natural size.
2. A leaf, natural size.
3. A fruiting branch of the dwarf form from northern California, natural size.



C.E.Faxon del. *Rapine sc.*

QUERCUS GARRYANA. Hook.

A.Riocreux direx.t *Imp. J.Taneur, Paris*

C.E.Faxon del. *Himely sc.*

QUERCUS GARRYANA, Hook.

A.Riocreux direx.t *Imp. J. Taneur, Paris.*

QUERCUS GAMBELII.

White Oak. Shin Oak.

LEAVES broadly obovate to oblong-lanceolate, pubescent on the lower surface, variously lobed or pinnatifid, the lobes entire, emarginate or lobed.

Quercus Gambelii, Nuttall, *Jour. Phil. Acad.* n. ser. i. pt. ii. 179 (1848). — Torrey, *Sitgreaves' Rep.* 172, t. 18; *Bot. Mex. Bound. Surv.* 205. — Liebmann, *Oversigt Dansk. Vidensk. Selsk. Forhandl.* 1854, 169. — Örsted, *Liebmann Chênes Am. Trop.* 22, t. 40, f. 1. — Hemsley, *Bot. Biol. Am. Cent.* iii. 171. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 189. — Greene, *West Am. Oaks*, 23, t. 13, f. 1, 2; pt. ii. 71, t. 33. — Sargent, *Garden and Forest*, ii. 471. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 415 (*Man. Pl. W. Texas*). — Koehne, *Gartenflora*, xliv. 6, f. 2–10.

Quercus alba *β* **? Gunnisonii**, Torrey, *Pacific R. R. Rep.* ii. pt. i. 130 (1855). — Watson, *King's Rep.* v. 321. — Porter, *Hayden's Rep.* 1871, 493. — Porter & Coulter, *Syn. Fl. Colorado*, 127.

Quercus stellata, δ **Utahensis**, A. de Candolle, *Prodr.* xvi. pt. ii. 22 (1864).

Quercus Douglasii, *β* **? Gambelii**, A. de Candolle, *Prodr.* xvi. pt. ii. 23 (1864).

Quercus Douglasii, *γ* **Novomexicana**, A. de Candolle, *Prodr.* xvi. pt. ii. 24 (1864).

Quercus undulata, Watson, *Am. Nat.* vii. 302 (*Plants of Northern Arizona*) (in part) (1873).

Quercus undulata, *a* **Gambelii**, Engelmann, *Trans. St. Louis Acad.* iii. 382, 392 (1876). — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 139. — Coulter, *Man. Rocky Mt. Bot.* 333.

Quercus Gambelii, var. **Gunnisonii**, Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 190 (1885).

Quercus venustula, Greene, *West Am. Oaks*, pt. ii. 69, t. 32 (1890).

Usually a shrub, forming by vigorous stolons broad low thickets varying from three or four to fifteen or twenty feet in height, the central stems often rising high above the others and assuming the habit of trees; or less commonly a tree, twenty or twenty-five feet in height, with a trunk a foot in diameter, or, rarely, forty or fifty feet in height, with a trunk eighteen inches in diameter, and slender branches spreading nearly at right angles from the stem and forming a narrow round-topped head. The bark of the trunk is from one half to three quarters of an inch in thickness, and is deeply divided into broad irregular often connected flat ridges separating on the surface into thin dark gray scales frequently tinged with red or light brown. The branchlets are slender, and, when they first appear, are coated with short pale or ferrugineous tomentum; in their first winter they are light orange-color or reddish brown, glabrous or puberulous, and, gradually growing darker or sometimes ashy gray during their second and third years, ultimately become dark brown or gray. The buds are ovate, acute or obtuse, covered with light chestnut-brown pubescent scales, and about an eighth of an inch in length. The leaves are convolute in the bud, broadly obovate to oblong-lanceolate, wedge-shaped or sometimes narrowed and rounded or broad and cordate at the base, and slightly or deeply divided by narrow or broad sinuses into from five to thirteen lobes, or pinnatifid; the terminal lobe is acute or rounded and three-lobed at the apex, and the lateral lobes are oblique, orbicular, broadly rounded, emarginate or auriculate or lobed, or are narrow, rounded or acute and entire or lobed; when the leaves unfold they are coated below with thick white tomentum and above with scattered stellate pubescence, and at maturity they are thick and firm, glabrous or rarely stellate-pubescent, lustrous and dark or yellow-green, or dull green above, and paler, often yellowish and soft-pubescent below; they are from three to five inches in length and from one to five inches in width, with prominent pale midribs hirsute on the under and occasionally also on the upper side, primary veins deviating at broad or acute angles and running to the points of the lobes, secondary veins arcuate and united near the margins and conspicuous veinlets; they are borne on stout persistent petioles flattened above, and turn

scarlet or orange-color before falling in the autumn. The stipules are linear, scarious, dark brown, hirsute with long pale hairs, and caducous. The flowers appear in May and June, when the leaves are nearly half grown. The sterile flowers are borne in slender hirsute aments in the axils of ovate acute bracts about twice as long as the hirsute yellow calyx, which is divided into five or six acute lobes rather shorter than the stamens; the anthers are emarginate, yellow, and glabrous. The bright red pistillate flowers are sessile or short-stalked, and solitary or in elongated few-flowered spikes, with ovate rounded involucral scales coated with soft pale tomentum, and acute calyx-lobes. The acorns are sessile or pedunculate and ripen in August and September; the nut is usually oval, broad at the base, obtuse and rounded or sometimes narrowed and acute at the apex, which is covered with rusty pubescence, and usually about three quarters of an inch long and five eighths of an inch broad; frequently, however, it does not exceed a quarter of an inch in length, and occasionally it is more than an inch long; when fully ripe it is at first dark chestnut-brown or nearly black, and ultimately turns light chestnut-brown; the cups are saucer-shaped, cup-shaped, or rarely turbinate, and although occasionally shallow, generally inclose about a third of the nut; they are light brown and pubescent on the inner surface, coated on the outer surface with pale tomentum, and much roughened below by the thickened and more or less united ovate scales; these are rounded on the back and narrowed, except at the base of the cup, into short free scarious pointed tips, and are thin and minute near the rim of the cup; or sometimes the lower scales are only slightly thickened and are free, with long loose tips.[1]

Quercus Gambelii is distributed from the eastern slopes of the Rocky Mountains of Colorado, where it finds its most northern home on the divide between the waters of the Platte and Arkansas Rivers at elevations of from six to seven thousand feet above the level of the sea, westward to the Wahsatch Mountains of Utah, and southward over the mountain ranges and high plateaus to the mouth of the Pecos River in Texas, the Charlestown Mountains in southwestern Nevada,[2] and the mountains of northern Sonora. Common on the foothills of the Rocky Mountains, where it usually grows as a low shrub, it occasionally rises in their sheltered cañons to the size of a small tree; more abundant in southern, and especially in southwestern Colorado, where it is the only Oak and often ascends to elevations of nearly ten thousand feet, it frequently covers hillsides with nearly uninterrupted thickets thousands of acres in extent and usually only two or three feet high; it is very abundant on the mountains of northern New Mexico and western Texas; it is the common Oak of the Colorado plateau and of southern Utah and northern Arizona, where it is scattered irregularly through the great forest of *Pinus ponderosa*, sometimes in broad clumps and often as isolated trees, probably attaining its largest size in northern Arizona at elevations of from six to seven thousand feet above the level of the sea; it is scattered through the open forests of *Pinus monophylla*, which clothe the mountain ranges of southern Nevada, and high up on those of southern New Mexico and Arizona it forms a narrow fringe above the groves of evergreen Oaks which enliven their lower slopes and just below the Nut Pines which usually crown their summits.

[1] Three quite distinct forms of this species can be distinguished by the shape and coloring of the leaves, although they are connected by innumerable varieties and all three of them sometimes grow together in areas only a few yards square.

The leaves of the first form (Plate cccLxvi. f. 1) are usually obovate in outline with few broad and rounded or emarginate lobes, and are dark green and lustrous on the upper surface.

In the second form (*Quercus venustula*) the leaves (Plate cccLxvii. f. 3) are oblong-lanceolate, sinuately lobed, usually smaller and bright yellow-green on the upper surface.

In the third form the leaves (Plate cccLxvii. f. 2) are oblong, broad at the abruptly rounded or cordate base, divided deeply or slightly by narrow sinuses into broad rounded entire lobes, and dull green on the upper surface.

Shrubby plants bearing leaves of the first and second of these forms are mixed together indiscriminately on the mountains of southern Colorado and northern New Mexico, and can be readily distinguished from a considerable distance by the color of the foliage. Plants of the third form I have seen only on the hills near the city of Durango in southwestern California; they were shrubs without fruit, and grew in clumps among those of the two other forms. Arborescent individuals usually produce large dark green deeply lobed leaves, especially on the Colorado plateau, and this appears to be the only form on the mountains of southern New Mexico and Arizona.

[2] Merriam, *North American Fauna*, No. 7, 333 (*Death Valley Exped.* ii.). — Coville, *Contrib. U. S. Nat. Herb.* iv. 197 (*Bot. Death Valley Exped.*).

The wood of *Quercus Gambelii* is heavy, hard, strong, and often tough, although difficult to season. It contains numerous conspicuous medullary rays and narrow bands of small open ducts marking the layers of annual growth, and is dark red-brown, with thin lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.8407, a cubic foot weighing 52.39 pounds.[1] It is largely used for fuel, and the bark is occasionally of service in tanning leather. The acorns, which are sometimes quite sweet, were probably eaten by the Indians.

Quercus Gambelii was discovered in 1844 on the banks of the Rio Grande by William Gambel,[2] whose memory is preserved in the association of his name with this beautiful little tree, which with its lustrous summer green and brilliant autumn tints delights the traveler through the sombre forests of the central regions of the continent.

[1] Some idea of the slow rate at which the wood of this species is formed may be obtained from the log specimen in the Jesup Collection of North American Woods in the American Museum of Natural History in New York, obtained from the neighborhood of Cañon City, Colorado. It is ten and a quarter inches in diameter inside the bark, and shows one hundred and fifty-eight layers of annual growth.

[2] William Gambel was born in New Jersey. In his youth he appears to have attracted the attention of Thomas Nuttall, the naturalist, who employed him as an assistant. In 1844 Gambel visited the southern Rocky Mountains with a party of trappers to collect birds and plants for the Academy of Natural Sciences of Philadelphia. Returning to Philadelphia the following year, he entered the Medical School of the University of Pennsylvania, from which he was graduated in 1848. He was soon elected recording secretary of the Philadelphia Academy, but retired from this position the following year and joined a party organized to cross the continent to the California gold-fields under the leadership of I. J. Wistar, afterward a distinguished officer in the Union army, a philanthropist and president of the Philadelphia Academy. The party started from Independence about the first of May, and proceeded up the Platte valley, where Gambel left it to join a party of Missourians led by a Captain Boone of Kentucky. Gambel's fate is described in the following extract of a letter from General Wistar: —

"In the year 1850, I met two men of Boone's train at Foster's Bar, who gave me the first information I had received of the fate of the majority of their overland party. Being well furnished and provisioned and mostly older men than we, they traveled leisurely and reached the Sierras only in October. After the loss of most of their cattle and consequent abandonment of many wagons in the Humboldt desert, they were caught by snow in the mountains; and instead of abandoning the remainder and pushing through, they camped to await better weather, which did not come. The snow constantly accumulated, all the cattle died, provisions were consumed, and when too late they made snowshoes and tried to save themselves. But few got across the range, including Gambel, and those saved little but what they stood in. With numbers rapidly diminishing, the remnant pushed on down to Rose's Bar, where several, including Gambel, died almost immediately of typhoid fever. Gambel was buried on the Bar, which, however, as I have understood, has since been entirely removed by hydraulic mining. His death occurred in the latter part of November, 1849, and I have never since seen any of the survivors of his party or heard any further particulars.

"He was a genial, kindly man and delightful companion, but averse to the rough life, hard work, and short commons then inseparable from such a journey. He was about twenty-eight at the time of his death, and, had he lived to cultivate more congenial pursuits at home, would certainly have attained increased distinction as a naturalist. His taste for natural science was great, his attainments considerable, and his work, even in youth, valuable." (See, also, Meehan, *The Native Flowers and Ferns of the United States*, ser. 2, ii. 62.)

Nuttall described the new genera and species discovered by Gambel in his first journey to the Rocky Mountains, dedicating to him the genus *Gambelia*, formed to receive a shrub with beautiful scarlet flowers from the island of Santa Catalina off the California coast, and now merged into Antirrhinum.

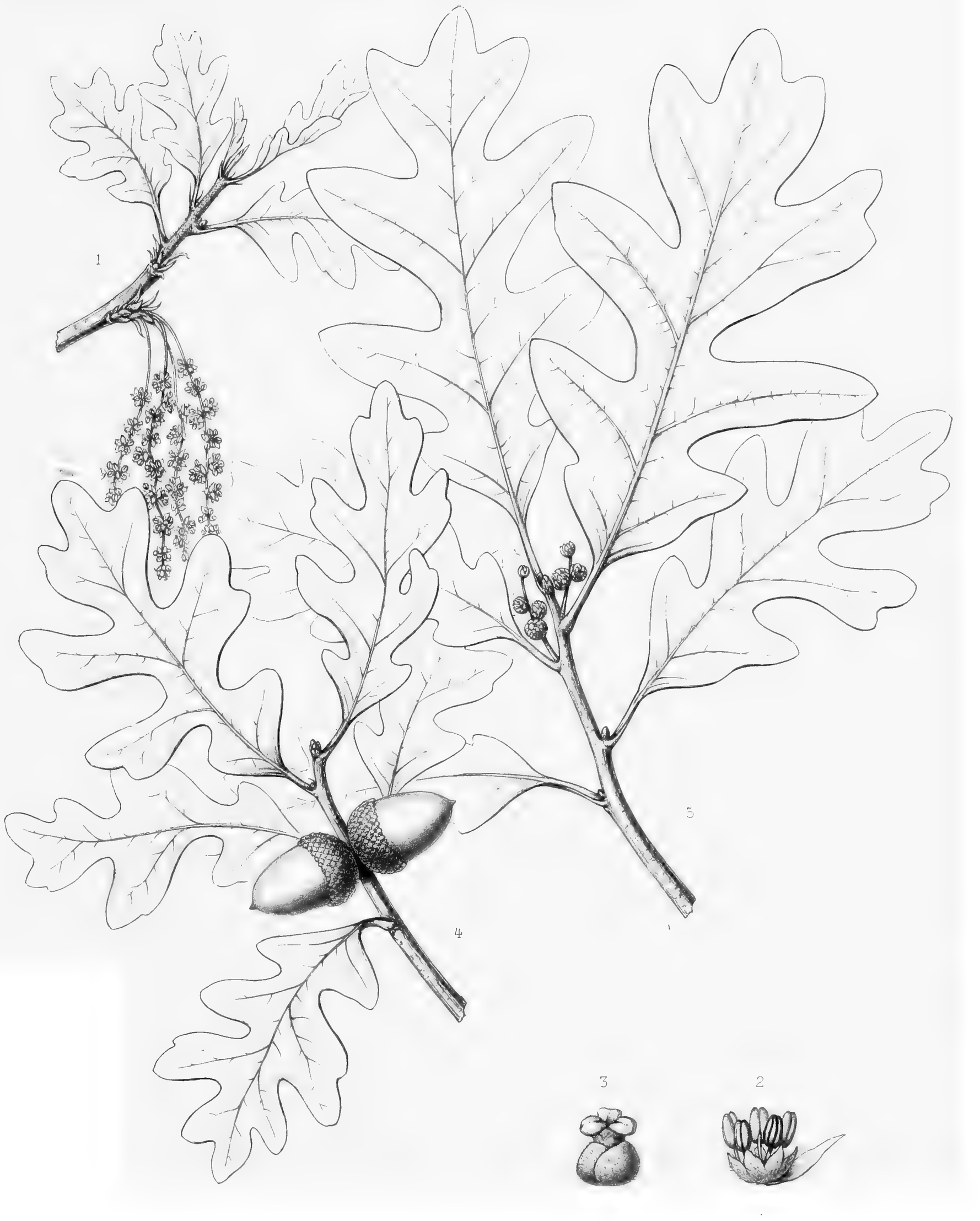
EXPLANATION OF THE PLATES.

Plate CCCLXVI. Quercus Gambelii.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A branch with spicate undeveloped fruit, natural size.

Plate CCCLXVII. Quercus Gambelii.

1. A fruiting branch, natural size.
2. A leaf, natural size.
3. A leaf, natural size.
4. A fruit, natural size.
5. A fruit, natural size.
6. A winter branchlet, natural size.



C.E.Faxon del. *Rapine sc.*

QUERCUS GAMBELII, Nutt.

A.Riocreux direx.t *Imp. J.Taneur, Paris.*

C.E. Faxon del. Himely sc.

QUERCUS GAMBELII, Nutt.

A. Riocreux direct. Imp. J. Taneur, Paris.

QUERCUS MINOR.

Post Oak.

LEAVES oblong-obovate, usually 5-lobed, pubescent on the lower and roughened with stellate hairs on the upper surface.

Quercus minor, Sargent, *Garden and Forest*, ii. 471 (1889). — Sudworth, *Rep. Sec. Agric. U. S.* 1892, 327. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 414 (*Man. Pl. W. Texas*).

Quercus alba minor, Marshall, *Arbust. Am.* 120 (1785). — Muehlenberg & Willdenow, *Neue Schrift. Gesell. Nat. Fr. Berlin*, iii. 395.

Quercus stellata, Wangenheim, *Nordam. Holz.* 78, t. 6, f. 15 (1787). — Smith & Abbot, *Insects of Georgia*, i. 93, t. 47. — Willdenow, *Spec.* iv. pt. i. 452; *Enum.* 977; *Berl. Baumz.* ed. 2, 349. — Persoon, *Syn.* ii. 570. — *Nouveau Duhamel*, vii. 180. — Hayne, *Dendr. Fl.* 161. — Nuttall, *Sylva*, i. 13. — Spach, *Hist. Vég.* xi. 156. — Emerson, *Trees Mass.* 133, t. 3; ed. 2, i. 151, t. — Dietrich, *Syn.* v. 311. — A. de Candolle, *Prodr.* xvi. pt. ii. 22 (excl. var. γ and δ). — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 340 (excl. var. γ and δ). — Koch, *Dendr.* ii. pt. ii. 52. — Engelmann, *Trans. St. Louis Acad.* iii. 389. — Lauche, *Deutsche Dendr.* 295. — Houba, *Chênes Am. en Belgique*, 265, t. — Watson & Coulter, *Gray's Man.* ed. 6, 475. — Dippel, *Handb. Laubholzk.* ii. 79. — Koehne, *Deutsche Dendr.* 128.

?Quercus villosa, Walter, *Fl. Car.* 235 (1788).

Quercus obtusiloba, Michaux, *Hist. Chênes Am.* No. 1, t. 1 (1801); *Fl. Bor.-Am.* ii. 194. — Michaux f. *Hist. Arb. Am.* ii. 36, t. 4. — Pursh, *Fl. Am. Sept.* ii. 632. — Nuttall, *Gen.* ii. 215. — Elliott, *Sk.* ii. 606. — Hooker, *Fl. Bor.-Am.* ii. 158. — Torrey, *Fl. N. Y.* ii. 190. — Gray, *Man.* 414. — Scheele, *Roemer Texas*, 446. — Darlington, *Fl. Cestr.* ed. 3, 265. — Brendel, *Trans. Ill. Agric. Soc.* iii. 615, t. 2. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 32. — Chapman, *Fl.* 423. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 66; *Liebmann Chênes Am. Trop.* t. H, t. 33, f. 60. — Vasey, *Am. Ent. and Bot.* ii. 250, f. 158. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 178. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 138. — Mayr, *Wald. Nordam.* 144, t. 1, 2.

Quercus Drummondii, Liebmann, *Oversigt Dansk. Vidensk. Selsk. Forhandl.* 1854, 170. — Örsted, *Liebmann Chênes Am. Trop.* 22.

Quercus stellata, β **Floridana**, A. de Candolle, *Prodr.* xvi. pt. ii. 22 (1864). — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 340.

A tree, rarely a hundred feet in height,[1] with a trunk two or three feet in diameter, and stout spreading branches which form a broad dense round-topped head, but usually not more than fifty or sixty feet tall, with a trunk one or two feet in diameter, and at the northeastern limits of its range generally reduced to a shrub. The bark of the trunk varies from half an inch to nearly an inch in thickness, and is gray more or less deeply tinged with brown, and divided by deep fissures into broad ridges covered on the surface with narrow closely appressed scales. The branchlets are stout and marked with small pale lenticels, and when they first appear are coated, as are the young leaves and petioles, the stalks of the aments of staminate flowers, and the peduncles of the pistillate flowers, with thick orange-brown tomentum; this gradually falls from the branchlets, and in their first winter they are light orange-colored to reddish brown and covered with short soft pale pubescence which sometimes does not entirely disappear until their third year, when they are gray, dark brown, or nearly black, or bright brown tinged with orange-color. The buds are broadly ovate, rather obtuse, or rarely acute, and usually rather less than an eighth of an inch, although occasionally nearly a quarter of an inch in length, and are covered with bright chestnut-brown pubescent scales coated toward the margins with scattered pale hairs. The leaves are convolute in the bud, generally broadly oblong-obovate in outline, gradually narrowed and wedge-shaped or occasionally abruptly narrowed and wedge-shaped or rounded at the base, and deeply divided by a pair of wide lateral sinuses, which are oblique at the bottom, into two basal lobes and two upper lobes separated from the terminal lobe by narrow sinuses acute or rounded at the bottom; the terminal

[1] Ridgway, *Proc. U. S. Nat. Mus.* xvii. 414.

lobe is obovate and deeply three-lobed with rounded lobes, or ovate and sometimes elongated and rounded and frequently emarginate at the apex, or rarely it is entirely suppressed and the broad apex of the leaf is truncate or emarginate; the lateral lobes are oblique, broadly obovate, rounded or emarginate at the apex, undulate or concave in outline on the upper margin, and furnished on the lower with a large lobe deeply emarginate or irregularly lobed at the broad apex; the basal lobes generally widen gradually from the bottom and then spread abruptly into small ovate rounded or slightly emarginate lobes, or are sometimes nearly triangular with undulate entire margins; on some trees in the southern states all the leaves are three-lobed at the apex with short broad rounded or pointed lobes, and are wedge-shaped and entire or undulate below; on many of the leaves of other trees the basal lobes are suppressed and the lateral lobes are very oblique, narrow, entire, and rounded at the apex; and occasionally a few individual leaves are oblong or oval and entire, or furnished on one side with a small entire lobe; when they unfold the leaves are dark red above, especially toward the apex; soon losing a large part of their dense pubescent covering, at maturity they are thick and firm, deep dark green on the upper surface, which is roughened with pale scattered stellate hairs, and covered on the lower surface with gray or light yellow or rarely silvery white pubescence, and before falling in the autumn they turn dull yellow or brown; they are usually four or five inches long and three or four inches across the upper lateral lobes, although they vary from two to eight inches in length and from an inch and a half to five inches in width; their midribs are broad, light-colored, and pubescent on the upper and tomentose or pubescent on the lower side; the veins which run to the points of the upper lateral lobes are much stouter than the others, and the lateral veins are arcuate and united near the margins and connected by conspicuous coarsely reticulate veinlets; the stout pubescent petioles are slightly flattened on the upper side and from half an inch to nearly an inch in length.[1] The stipules are brown, scarious, pubescent, and ciliate on the margins with long pale hairs, and obovate, rounded or acute at the apex; they are half an inch long and from one sixteenth to one eighth of an inch broad on the first leaves of the season, and, becoming gradually narrow, are linear on those at the end of the branchlet. The flowers appear when the leaves are about a third grown, from March in Texas to the end of May at the north; the staminate flowers are borne in aments three or four inches long and are produced from the axils of ovate acute hairy bracts rather longer than the hirsute yellow calyx, which is usually divided into five ovate acute laciniately cut segments; the anthers are emarginate, yellow, and covered with short scattered pale hairs. The pistillate flowers are sessile or pedunculate and covered with pale hairs; the stigmas are bright red. The acorns are usually sessile or occasionally short-pedunculate;[2] the nut is oval or ovate or ovate-oblong, broad at the base, obtuse and naked or covered with pale persistent pubescence at the apex, from one half of an inch to an inch long, and from one quarter to three quarters of an inch broad, and is sometimes striate with dark longitudinal stripes; the cup is cup-shaped or turbinate, or rarely saucer-shaped, and usually incloses from one third to one half of the nut, although rarely it is very shallow, embracing only the base of the nut; it is pale and pubescent on the inner and pale and tomentose on the outer surface, which is covered with thin free ovate scales rounded or acute at the apex, reddish brown, and sometimes, toward the rim of the cup, ciliate on the margins with long pale hairs.[3]

[1] In the northern and middle states the leaves of *Quercus minor* are quite constantly five-lobed with broad three-lobed or entire terminal lobes and two broad lateral lobes separated by wide sinuses from the small basal lobes. In the south, however, the leaves are often extremely variable on the same or on different individuals, and in a small grove of these trees on limestone soil near Austin, Texas, I found leaves varying from what may be called the normal five-lobed form to trifid, one-lobed, undulate and entire, or subentire forms, and from two to five inches in length (Plate ccclxix. f. 1, 2, 3). Trees with rather thin trifid leaves seven or eight inches long and four or five inches wide I have seen only near Mobile, Alabama, where they grow side by side with those bearing leaves of the normal shape (Plate ccclxix. f. 4).

[2] Near Austin, Texas, individual trees of *Quercus minor* produce acorns with large broadly ovate nuts pubescent at the apex and inclosed nearly to the middle in deep turbinate cups (Plate ccclxix. f. 5), while the acorns of others growing with them have ovate oblong narrow glabrous nuts and shallow saucer-shaped cups (Plate ccclxix. f. 6). I have not seen such acorns in other parts of the country on this species, which usually produces short oval nuts about half an inch in length and cup-shaped or slightly turbinate cups. In all the forms of fruit the cup-scales are thin and remarkably homomorphous, and no other North American White Oak appears to vary so little in the character of the cup-scales.

[3] Two trees discovered by Dr. J. H. Mellichamp near Bluffton, South Carolina, several years ago, but now destroyed, were consid-

Quercus minor is distributed from Brewster near the eastern extremity of Cape Cod,[1] the islands of Martha's Vineyard and Naushon off the coast of southern Massachusetts, North Kingston, Rhode Island,[2] and Long Island, New York, to northern Florida and southern Alabama and Mississippi; from New York it ranges westward to Missouri, eastern Kansas,[3] the Indian Territory, and Texas, where it extends southward to the valley of the San Antonio River and westward to the one hundredth meridian of west longitude.[4] Growing on the dry and sandy wind-swept soil of Martha's Vineyard, the Post Oak is usually shrubby with low and much contorted stems; of larger size in Rhode Island and on Long Island, it is more abundant farther south, and from the coast of the south Atlantic and the eastern Gulf states to the lower slopes of the Appalachian Mountains, and in the Mississippi basin it is one of the common Oak-trees on dry gravelly uplands, where it grows to its largest size; it is the most abundant Oak of central Texas, being usually found on limestone hills and sandy plains, and toward the western limits of its range, in Texas and the Indian Territory, it forms with *Quercus Marilandica* an open forest belt to which the name of the "Cross Timbers" was given by the early travelers and settlers.

The wood of *Quercus minor* is very heavy, hard, close-grained, and durable in contact with the soil, although it is difficult to season, checking badly in drying. It contains numerous conspicuous medullary rays and bands of one to three rows of small open ducts marking the layers of annual growth, and is light or dark brown, with thick lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.8367, a cubic foot weighing 52.14 pounds. It is largely used for fuel, fencing, and railway ties, and in some states west of the Mississippi River, especially in Texas, in the manufacture of carriages, for cooperage, and in construction.

Long confounded with the White Oak, *Quercus minor* was first distinguished by the Pennsylvania botanist, Humphry Marshall,[5] who published the earliest description of it, in 1785, in his *Arbustum Americanum*. According to Aiton,[6] it was introduced into English plantations in 1800, although it is probable that the French botanist Michaux[7] had sent it to France before the end of the last century.

Its dense round-topped head and its dark foliage, which at a distance sometimes appears nearly black, make it easy to recognize the Post Oak in the landscape; and, always a beautiful tree, it might be used to advantage in the decoration of parks and pleasure-grounds in the eastern United States.

ered by Dr. Engelmann as possible hybrids between *Quercus minor* and *Quercus alba*. The buds of both trees were larger than those usually produced by *Quercus minor;* the first had the normal leaves of *Quercus minor*, glabrous branchlets and anthers, and the second had rather narrow cuneate leaves with oval lobes and glabrous branchlets; the stamens of the latter and the mature fruit of both are unknown (Engelmann, *Trans. St. Louis Acad.* iii. 389, 398).

[1] Farlow, *Garden and Forest*, ii. 48.

[2] L. W. Russell, *Garden and Forest*, ii. 34.

[3] Mason, *Eighth Bienn. Rep. State Board Agric. Kansas*, 271.

[4] Havard, *Proc. U. S. Nat. Mus.* viii. 505.

[5] Humphry Marshall (1722–1801), the son of a Pennsylvania farmer who emigrated from England in 1697, and the eighth of nine children, was born in West Bradford, Chester County. After leaving school at the age of twelve, he worked on his father's farm until he was sent to learn the trade of a stone-mason. He appears to have inherited a large part of the paternal farm, which he managed for some time after his father's death in 1767, and upon which he continued to live until 1774, when he removed to a tract of land near the Bradford Meeting-house, now the town of Marshallton in Chester County, where he had built with his own hands a substantial stone house that still bears witness to his skill as a mason and the thoroughness of his work. Marshall was a relative of John Bartram, who planted near Philadelphia the first botanic garden in the New World and was the principal American botanist of his time, and from him, no doubt, he acquired that love of botany which has made his name also famous. Like Bartram, he collected plants and seeds for English correspondents; and when he established his new home at Bradford Meeting-house he planted about his house a collection of trees and shrubs which lovers of plants still visit with interest and pleasure. Five years later Marshall began to prepare an account of the forest trees of the United States. This was published in 1785 in a duodecimo volume of one hundred and seventy-nine pages, and was entitled the *Arbustum Americanum, The American Grove, or an alphabetical catalogue of forest trees and shrubs natives of the American United States.* Apart from its value as a record of the observations of an acute field botanist of excellent judgment, the *Arbustum Americanum* is of special interest as the first book of botany written and published by an American. Reappearing in German and French editions, it received wide recognition at the time of its publication, and students of American trees will always consult it. The memory of Humphry Marshall is also preserved by *Marshallia*, a genus of herbs of the southern United States, dedicated to him by the German botanist Schreber. (See Darlington, *Memorials of John Bartram and Humphrey Marshall*, 485.)

[6] *Hort. Kew.* ed. 2, v. 294. — Loudon, *Arb. Brit.* iii. 1870, f. 1732, t.

[7] See i. 58.

EXPLANATION OF THE PLATES.

Plate CCCLXVIII. Quercus minor.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. Portion of the upper surface of a mature leaf showing the stellate hairs, enlarged.
6. A winter branchlet, natural size.

Plate CCCLXIX. Quercus minor.

1. A fruiting branch showing nearly entire and deeply lobed leaves, natural size.
2. A leaf, natural size.
3. A leaf, natural size.
4. A leaf, natural size.
5. A fruit with a deep cup, natural size.
6. A fruit with a shallow cup, natural size.

C. E. Faxon del. *Migneaux sc.*

QUERCUS MINOR, Sarg.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

C.E. Faxon del.

Himely sc.

QUERCUS MINOR, Sarg.

A. Riocreux direx.t

Imp J Taneur, Paris.

QUERCUS CHAPMANI.

LEAVES oblong or oblong-obovate, entire or slightly sinuate-lobed toward the apex.

Quercus Chapmani, Sargent, *Garden and Forest*, viii. 93 (1895).

Quercus obtusiloba, var. **parvifolia**, Chapman, *Fl.* 423 (not *Quercus Robur*, var. *parvifolia*, Lorey & Durey) (1860). — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 178.

Quercus stellata, Engelmann, *Trans. St. Louis Acad.* iii. 389 (in part) (1877).

Usually a rigid shrub, producing fruit on stems only one or two feet tall, but occasionally rising to thirty feet in height, with a trunk a foot in diameter covered with dark bark separating into large irregular plate-like scales, and stout branches forming a round-topped head. The branchlets are slender and marked with small scattered pale lenticels; they are coated at first with dense bright yellow pubescence, which soon begins to disappear, and becoming light or dark brown and puberulous during their first winter, they ultimately turn ashy gray. The winter-buds are ovate, acute or obtuse, and about an eighth of an inch long, and are covered with glabrous or puberulous light chestnut-brown scales. The leaves are convolute in the bud, from oblong to oblong-obovate, gradually narrowed and wedge-shaped or rounded or broad and rounded at the base, rounded at the apex, and entire, with slightly undulate margins or obscurely sinuate-lobed toward the apex; or, on vigorous shoots, they are often coarsely sinuately divided or deeply lobed and pubescent or tomentose below, the lobes frequently terminating in short rigid points; when they unfold they are coated below with thick bright yellow pubescence and are covered above with pale stellate deciduous hairs, and at maturity they are thick and firm or subcoriaceous, dark green, glabrous and lustrous on the upper surface, and light green or silvery white and glabrous on the lower, except along the slender midribs, which are sometimes pubescent or puberulous; they are two or three inches long and an inch wide, but occasionally from four to five inches in length and from two to three inches in breadth, or often not more than an inch long and three quarters of an inch wide, with slender veins arcuate and united near the margins or running to the ends of the lobes, and obscure reticulate veinlets; they are borne on broad petioles grooved on the upper side and rarely exceeding an eighth of an inch in length, and fall gradually during the winter, or sometimes remain on the branches until the appearance of those of the next season. The flowers open when the leaves are about a third grown, or on some individuals when they have attained nearly their full size. The staminate flowers are produced in short hirsute aments; the calyx is hirsute and usually divided into five acute laciniately cut segments, and the stamens are emarginate and hirsute. The pistillate flowers are sessile or short-pedunculate, and their involucral scales, like the peduncles, are coated with dense pale tomentum. The acorns are usually sessile, and solitary or in pairs; the nut is oval, about five eighths of an inch long and three eighths of an inch broad, and is clothed with pale pubescence from the obtuse rounded apex nearly to the middle; the cup is deeply cup-shaped or turbinate, and incloses nearly half of the nut; it is light brown and slightly pubescent on the inner surface, and is covered by ovate oblong long-pointed scales thickened on the back, especially toward the base of the cup, and coated with pale tomentum except on their thin reddish brown margins.

Quercus Chapmani is distributed from South Carolina to Florida, and inhabits sandy barren Pine lands usually in the immediate neighborhood of the coast. Comparatively rare on the Atlantic seaboard and in the interior of the Florida peninsula, it is very abundant in western Florida, where it is found from the shores of Tampa Bay to Appalachicola and Santa Rosa Island. Usually a shrub, it has only been reported as a tree in the streets of Tampa and in the neighborhood of Appalachicola.

The character and value of the wood are not known.

Long considered a variety of the Post Oak, which it resembles in the nature and color of the pubescent covering of the young branches and the under surface of the leaves, and in the hairy anthers, *Quercus Chapmani* differs from that species in its larger and more acute winter-buds, in its smaller and usually entire or only slightly sinuately lobed leaves, which are glabrous at maturity on the upper surface, and in the thicker scales of its cup, and seems entitled to specific rank.

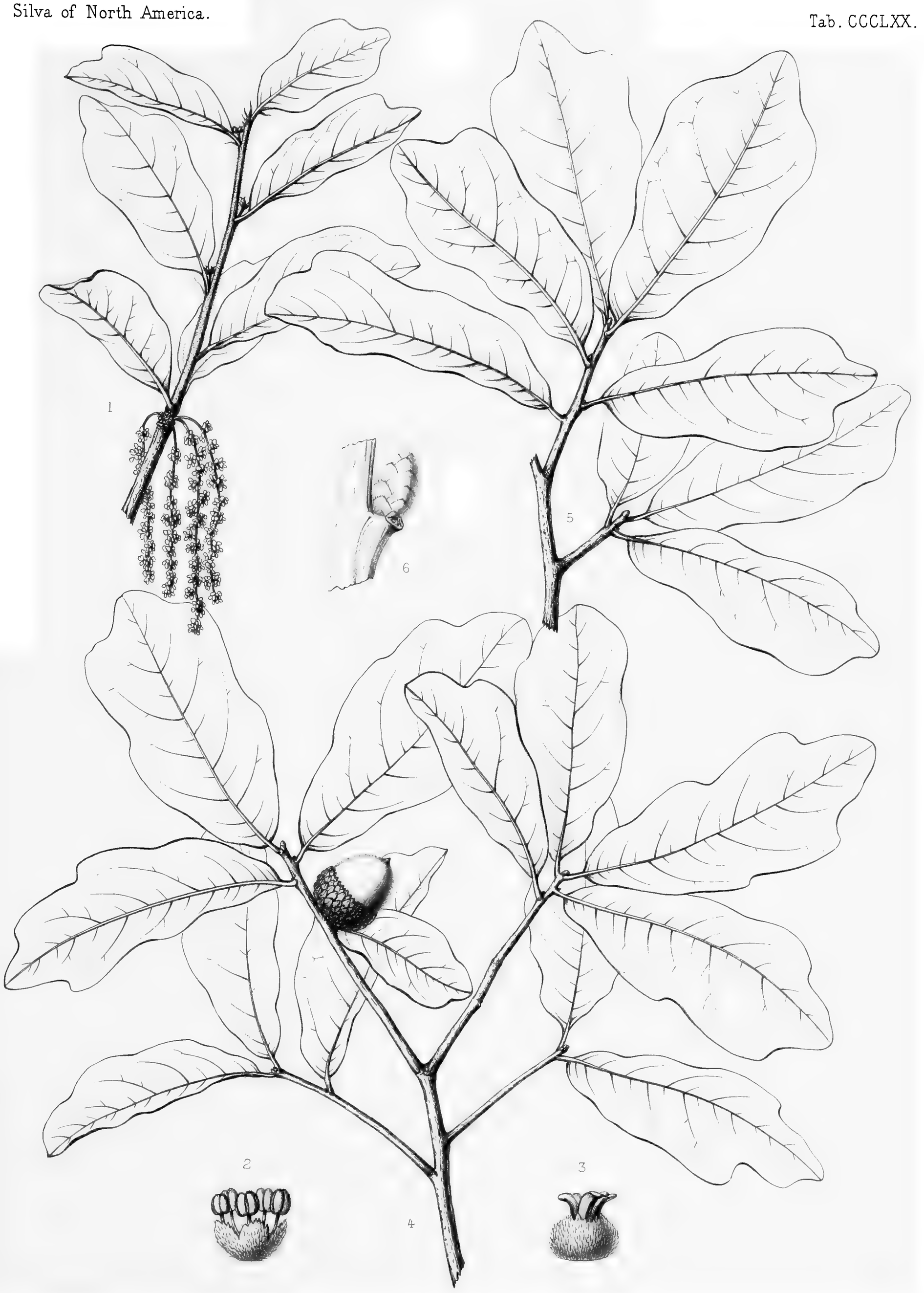
The varietal name by which this tree was first designated having been previously used for another Oak, the name of the venerable author of the *Flora of the Southern United States*, Dr. Alvan Wentworth Chapman,[1] who first distinguished and described it, has been given to it.

[1] See vii. 110.

EXPLANATION OF THE PLATE.

PLATE CCCLXX. QUERCUS CHAPMANI.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A sterile branch, natural size.
6. An axillary winter-bud, enlarged.



C.E. Faxon del.

Lebrun sc.

QUERCUS CHAPMANI, Sarg.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

QUERCUS MACROCARPA.

Bur Oak. Mossy Cup Oak.

LEAVES obovate or oblong, lyrately pinnatifid or deeply sinuately lobed or divided, usually pale and pubescent on the lower surface.

Quercus macrocarpa, Michaux, *Hist. Chênes Am.* No. 2, t. 2, 3 (1801); *Fl. Bor.-Am.* ii. 194. — Willdenow, *Spec.* iv. pt. i. 453; *Enum.* 977; *Berl. Baumz.* ed. 2, 350. — Persoon, *Syn.* ii. 570. — Poiret, *Lam. Dict.* Suppl. ii. 224. — Michaux f. *Hist. Arb. Am.* ii. 34, t. 3. — Pursh, *Fl. Am. Sept.* ii. 632. — Nuttall, *Gen.* ii. 215. — *Nouveau Duhamel*, vii. 182. — Hayne, *Dendr. Fl.* 161. — Sprengel, *Syst.* iii. 863. — Spach, *Hist. Vég.* xi. 159. — Torrey, *Fl. N. Y.* ii. 191, t. 108. — Emerson, *Trees Mass.* 132, t. 2, f. 2; ed. 2, i. 149, t. — Scheele, *Roemer Texas*, 447. — Dietrich, *Syn.* v. 311. — Brendel, *Trans. Ill. Agric. Soc.* iii. 621, t. 5. — Chapman, *Fl.* 423. — A. de Candolle, *Prodr.* xvi. pt. ii. 20. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 67; *Liebmann Chênes Am. Trop.* t. G, t. 33, f. 27, 28. — Vasey, *Am. Ent. and Bot.* ii. 250, f. 157. — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 335, t. 2. — Koch, *Dendr.* ii. pt. ii. 51. — Engelmann, *Trans. St. Louis Acad.* iii. 381, 389. — J. F. James, *Jour. Cincinnati Soc. Nat. Hist.* iv. 1, t. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 178. — Lauche, *Deutsche Dendr.* 295. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 140. — Houba, *Chênes Am. en Belgique*, 269, t. — Mayr, *Wald. Nordam.* 143, t. 2. — Watson & Coulter, *Gray's Man.* ed. 6, 475. — Dippel, *Handb. Laubholzk.* ii. 79. — Koehne, *Deutsche Dendr.* 128. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 414 (*Man. Pl. W. Texas*).

Quercus oliviformis, Michaux f. *Hist. Arb. Am.* ii. 32, t. 2 (1812). — Pursh, *Fl. Am. Sept.* ii. 632. — Nuttall, *Gen.* ii. 215; *Sylva*, i. 14. — *Nouveau Duhamel*, vii. 181. — Sprengel, *Syst.* iii. 864. — Loudon, *Arb. Brit.* iii. 1869, f. 1730. — Spach, *Hist. Vég.* xi. 159. — Torrey, *Fl. N. Y.* ii. 191. — Gray, *Man.* 414. — A. de Candolle, *Prodr.* xvi. pt. ii. 20. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 67. — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 336.

Quercus macrocarpa, var. **oliviformis**, Gray, *Man.* ed. 2, 404 (1856). — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 179. — Dippel, *Handb. Laubholzk.* ii. 80.

Quercus macrocarpa, *β* **abbreviata**, A. de Candolle, *Prodr.* xvi. pt. ii. 20 (1864). — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 335.

Quercus macrocarpa, *γ* **minor**, A. de Candolle, *Prodr.* xvi. pt. ii. 20 (1864). — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 335.

This is one of the largest Oaks of eastern North America, rising sometimes to a height of one hundred and sixty or one hundred and seventy feet, and forming a trunk six or seven feet in diameter and clear of limbs for seventy or eighty feet above the ground, and a broad head of great spreading branches with an ambitus of one hundred and twenty or one hundred and thirty feet. Trees of this size, however, are not common, the average height of the Bur Oak being hardly more than eighty feet, and its average trunk diameter not more than three or four feet, while toward the northwestern limits of its range it is sometimes reduced to a low shrub. During its early years the stout branches of some individuals grow nearly at right angles with the stem, and on others, spreading at narrow angles, form an open irregular head; but in its old age the Bur Oak, unless it has been crowded in the forest, develops a massive and beautiful round-topped crown of branches.[1] The bark of the trunk is from one to two inches in thickness, deeply furrowed, and broken on the surface into irregular plate-like light brown scales often slightly tinged with red. The branchlets are stout and marked with pale lenticels, and at first are coated with thick soft pale pubescence which usually soon disappears; during their first winter they are light orange-color and usually glabrous or occasionally slightly puberulous, and in their second year grow ashy gray or light brown, ultimately becoming dark brown; and the corky wings, often from an inch to an inch and a half in width, which are formed on the branches of some individuals and persist for several years, usually begin to develop, although frequently they do not appear, before the third or fourth season. The buds are broadly ovate, acute or obtuse, and from an eighth to nearly a

[1] *Garden and Forest*, ii. 497, f. 136; iii. 402, f. — *Forest Leaves*, iv. 22 f.

quarter of an inch in length, with light red-brown scales coated with soft pale pubescence. The leaves are convolute in the bud, obovate or oblong, and gradually contracted into long wedge-shaped or occasionally into narrow and rounded bases; they are sometimes divided by wide sinuses, which often penetrate nearly or quite to the midribs, into five or seven lobes; the terminal lobe is large, oval, or obovate in outline and regularly crenately lobed, or smaller and three-lobed at the rounded or acute apex; the upper lateral lobes are narrow, oblique, and three-lobed or variously crenately lobed at the apex, or oblong and rounded and entire at the apex, and much larger than the basal lobes, which are nearly triangular and entire or crenately lobed below; or the leaves are broadly obovate and deeply or slightly crenately lobed with equal or unequal rounded or occasionally acute lobes, or are pinnatifidly cut into five or seven pairs of narrow lateral rounded lobes gradually increasing in size from the lowest to the three-lobed apex of the leaf; when they unfold they are yellow-green and pilose above and silvery white and coated with long pale hairs below; and at maturity they are thick and firm, dark green, lustrous and glabrous or occasionally pilose on the upper surface, and pale green or silvery white on the lower surface, which is coated with soft pale or rarely rufous pubescence, and before falling in the autumn they turn dull yellow or yellowish brown; they are from six to twelve inches in length and from three to six inches in width, with stout pale midribs sometimes pilose on the upper side and pubescent on the lower, large primary veins running to the points of the principal lobes, secondary veins running to their divisions or arcuate and united within the slightly thickened and revolute margin, and conspicuous reticulate veinlets; the thick petioles are flattened and grooved on the upper side, much enlarged at the base, and from one third of an inch to an inch in length; the stipules are linear-obovate, or ovate from broad bases and then sometimes abruptly contracted in the middle, brown and scarious, pubescent, especially on the margins and toward the ends, and often an inch long; or those of the upper leaves are linear-lanceolate and frequently remain on the branches during the winter. The flowers open when the leaves are about a third grown, from March in Texas to the beginning of June in the north. The staminate flowers are borne in slender aments from four to six inches in length, with yellow-green stems coated with loosely matted pale hairs; the calyx is yellow-green, pubescent, and divided into from four to six laciniately cut acute segments ending in tufts of long pale hairs; the stamens are usually from four to six in number, with short filaments and yellow glabrous anthers. The pistillate flowers are sessile or pedunculate, with broadly ovate involucral scales often somewhat tinged with red toward the margins, and coated, like the peduncles, with thick pale tomentum; the stigmas are bright red. The acorns, which are usually solitary, are sessile or are borne on stout peduncles, sometimes two or three inches in length, and are exceedingly variable in size and shape; the nut is oval or broadly ovate, broad at the base and rounded at the acute obtuse or depressed apex, which is covered with soft fine pale pubescence; it varies from three fifths of an inch in length and one third of an inch in width on trees growing in the valley of the St. Lawrence River and in northern Minnesota, to two inches in length and an inch and a half in breadth on trees in eastern and central Texas; the cup is cup-shaped, and sometimes on northern trees thin and shallow, but on southern trees deep, thick, and woody; it sometimes embraces one third of the nut and sometimes all but its extreme apex, and is light brown and pubescent on the inner surface and coated with thick hoary tomentum on the outer surface; this is covered by large regularly imbricated ovate pointed scales, which at the base of the cup are sometimes thin and free and sometimes much thickened and more or less united and tuberculate, and near its rim are generally developed into long, slender pale awns varying greatly in length and numbers, and forming on northern trees a short inconspicuous and on more southern trees a long conspicuous matted fringe-like border to the cup.

Quercus macrocarpa usually inhabits low, rich bottom-lands or intervales, or sometimes, in the northwest, low dry hills. In British America it ranges from New Brunswick and Nova Scotia westward through the valley of the St. Lawrence River, where, in the neighborhood of Montreal, it is the common White Oak, and up the valley of the Ottawa River to Pembroke, through Ontario, where it is common,

and along the northern shores of Lake Huron; appearing again in the country south of Lake Winnipeg, it often forms groves of considerable extent in Manitoba, extending in depauperate forms to the mouth of Shell River, on the Assiniboine, and to the westward of Fort Ellice on the Qu'Appelle.[1] In the United States it occurs in the valley of the Penobscot River, in Maine; on the shores of Lake Champlain, in Vermont; in the valley of Ware River, in Massachusetts, and in Lancaster County, Pennsylvania, and ranges westward to the eastern foothills of the Rocky Mountains of Montana,[2] to western Nebraska[3] and central Kansas,[4] and southwestward to central Tennessee, the Indian Territory, and the valley of the Nueces River in Texas. Comparatively rare and local east of the Alleghany Mountains, it is common in the lowland forests of the Mississippi Basin and in eastern Texas, growing probably to its largest size in southern Indiana and Illinois;[5] it is the common species of the scattered Oak forests or "Oak Openings" of western Minnesota, where the eastern woodlands are gradually replaced by treeless prairies, and in all the basin of the Red River of the North, ranging farther to the northwest than any other species of eastern America, and as a low shrub maintaining a foothold in the cold dry regions of Manitoba, Dakota, and eastern Montana.[6] It is the most frequent and generally distributed Oak of Nebraska, attaining a large size in cañons and on river-bottoms in the extreme western part of the state, or remaining low and shrubby on dry hillsides. It is the most generally distributed Oak of Kansas also, growing to a large size near small creeks in all the eastern parts of the state, and spreading at the north to the valley of Bow Creek, in Phillips County, and to Sumner County in the south.

Quercus macrocarpa is one of the most valuable timber-trees of North America, its wood being superior in strength even to that of *Quercus alba*, with which it is commercially confounded. It is heavy, strong, hard, tough, close-grained, and very durable in contact with the soil. It contains conspicuous and often broad medullary rays and bands of from one to three rows of small open ducts marking the layers of annual growth, and is a dark or rich light brown in color, with thin much lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.7453, a cubic foot weighing 46.45 pounds. It is used in ship and boat building, for constructions of all sorts, and the interior finish of houses, in cabinet-making, in cooperage, in the manufacture of carriages, agricultural implements, and baskets, for railway ties and fencing, and for fuel.

Quercus macrocarpa was discovered by the French botanist Michaux in his journey west of the Alleghany Mountains in the spring of 1795.[7]

The vigor and rapid growth[8] of *Quercus macrocarpa* in cultivation, the beauty of its ample deeply lobed leaves, with the contrasting colors of their upper and lower surfaces, its handsome fruit and its curious and picturesque winter aspect, when the branches are furnished with their broad wings, make the Bur Oak one of the most interesting and desirable of American Oaks as an ornamental tree where it can be given room for its free development.

[1] Brunet, *Cat. Vég. Lig. Can.* 48. — Bell, *Rep. Geolog. Surv. Can.* 1879–80, 47°. — Macoun, *Cat. Can. Pl.* 441.

[2] Winchell, *Ludlow Rep. Black Hills, Dakota*, 68. — Warren, *Rep. Nebraska and Dakota*, 121.

[3] Bessey, *Rep. Nebraska State Board Agric.* 1894, 109.

[4] Mason, *Eighth Bienn. Rep. State Board Agric. Kansas*, 271; *Garden and Forest*, iv. 508.

[5] Ridgway, *Proc. U. S. Nat. Mus.* v. 81.

[6] *Quercus stellata*, γ *depressa*, A. de Candolle, *Prodr.* xvi. pt. ii. 22 (1864).

[7] In an entry for the 15th of June, 1795, written in his journal when he was within twelve miles of Nashville, Michaux makes the first mention of *Quercus macrocarpa* as "*Quercus glandibus magnis, capsulâ includentibus, nommés*, Overcup White Oak." (See *Proc. Am. Phil. Soc.* xxvi. 118 [*Journal of André Michaux*, 1795–1796].)

[8] The log specimen in the Jesup Collection of North American Woods in the American Museum of Natural History, New York, obtained from the neighborhood of Allenton, Missouri, is thirty-two and a half inches in diameter inside the bark, and shows two hundred and fifty-three layers of annual growth, fourteen of which are of sapwood.

EXPLANATION OF THE PLATES.

PLATE CCCLXXI. QUERCUS MACROCARPA.

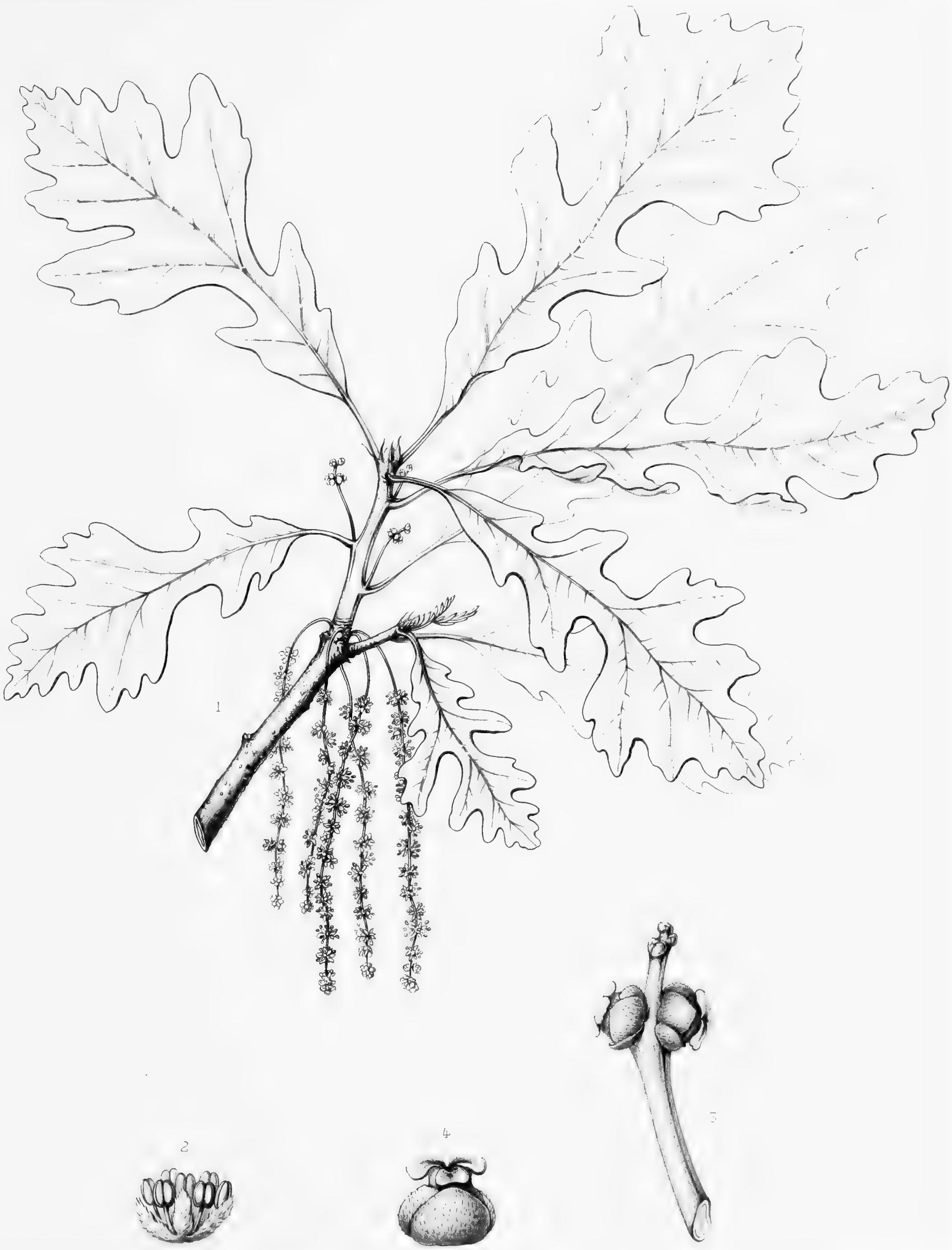
1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate inflorescence, enlarged.
4. A pistillate flower, enlarged.

PLATE CCCLXXII. QUERCUS MACROCARPA.

1. A fruiting branch, natural size.
2. A fruit, natural size.
3. A fruit, natural size.
4. A fruit, natural size.
5. A winter branchlet, natural size.

PLATE CCCLXXIII. QUERCUS MACROCARPA.

1. A branch with immature fruit, natural size.
2. A fruit, natural size.
3. A fruit, natural size.
4. A fruit, natural size.
5. A fruit, natural size.
6. A leaf, natural size.
7. A leaf, natural size.



C.E.Faxon del. *Migneaux sc.*

QUERCUS MACROCARPA, Michx.

A.Riocreux direx.t *Imp. J.Taneur, Paris.*

C.E. Faxon del. *Rapine sc.*

QUERCUS MACROCARPA, Michx.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

C.E.Faxon del.

Rapine sc.

QUERCUS MACROCARPA, Michx.

A.Riocreux direx.t

Imp. J.Taneur, Paris.

QUERCUS LYRATA.

Overcup Oak. Swamp White Oak.

LEAVES obovate-oblong, deeply 5 to 9-lobed, or pinnatifid, pubescent and usually silvery white on the lower surface.

Quercus lyrata, Walter, *Fl. Car.* 235 (1788). — Smith & Abbot, *Insects of Georgia*, ii. 165, t. 83. — Michaux, *Hist. Chênes Am.* No. 3, t. 4; *Fl. Bor.-Am.* ii. 195. — Willdenow, *Spec.* iv. pt. i. 453. — Persoon, *Syn.* ii. 570. — Poiret, *Lam. Dict.* Suppl. ii. 224. — Michaux f. *Hist. Arb. Am.* ii. 42, t. 5. — Pursh, *Fl. Am. Sept.* ii. 632. — Nuttall, *Gen.* ii. 215. — *Nouveau Duhamel*, vii. 181. — Elliott, *Sk.* ii. 607. — Sprengel, *Syst.* iii. 864. — Spach, *Hist. Vég.* xi. 156. — Dietrich, *Syn.* v. 311. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 33. — Chapman, *Fl.* 423. — A. de Candolle, *Prodr.* xvi. pt. ii. 19. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 66. — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 334, t. 1. — Koch, *Dendr.* ii. pt. ii. 53. — Engelmann, *Trans. St. Louis Acad.* iii. 389. — Ridgway, *Proc. U. S. Nat. Mus.* v. 80. — Lauche, *Deutsche Dendr.* 295. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 140. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 178. — Houba, *Chênes Am. en Belgique*, 273, t. — Watson & Coulter, *Gray's Man.* ed. 6, 475. — Mayr, *Wald. Nordam.* 146, t. 1, 2. — Dippel, *Handb. Laubholzk.* ii. 78, f. 31. — Koehne, *Deutsche Dendr.* 127. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 414 (*Man. Pl. W. Texas*).

A tree, rarely one hundred feet in height, with a trunk from two to three feet in diameter, generally dividing, fifteen or twenty feet above the base, into comparatively small often pendulous branches which form a handsome symmetrical round-topped head and sometimes sweep the ground with their extremities; or the trunk forks at narrow angles, and the branches, spreading gradually, form an oblong head; or they grow nearly horizontally and form a wider and less symmetrical head. The bark of the trunk is from three quarters of an inch to an inch in thickness, and is light gray tinged, sometimes conspicuously, with red, and broken into thick plates separating on the surface into thin irregular appressed scales. The branchlets are slender and covered with pale lenticels, and when they first appear are green more or less tinged with red and pilose with scattered pale hairs, or pubescent; during their first winter they are light or dark orange-colored or grayish brown and glabrous or rarely puberulous; and growing darker, in their second year ultimately become ashy gray or light brown. The buds are ovate, obtuse, about an eighth of an inch long, and covered with light chestnut-brown scales, which are clothed, especially near the margins, with loose pale tomentum. The leaves are convolute in the bud, obovate-oblong, gradually narrowed and wedge-shaped at the base and divided into from five to nine lobes by deep or shallow sinuses, those near the middle of the leaf being often wide, and round, straight, or oblique at the bottom; the terminal lobe is oblong-ovate, usually broad, acute at the elongated apex, and furnished with two small entire nearly triangular lateral lobes; the upper lateral lobes are oblong, ovate or obovate, broad and slightly or deeply emarginate, or narrowed and acute and often auriculate on the lower edge, and much longer than those below them, which are ovate, acute or rounded at the ends, usually entire and nearly twice as long as the nearly triangular entire basal lobes; when they unfold the leaves are bronze-green and pilose with caducous hairs on the upper surface and coated on the lower with thick pale tomentum, and are furnished on the teeth with small dark glands; at maturity they are thin and firm, dark green and glabrous above, silvery white or rarely light green and coated with pale pubescence below, from seven to eight inches long and from one to four inches broad across the upper lobes, with stout yellow midribs and primary veins running to the points of the lobes, which are usually tipped with minute points, and obscure reticulate veinlets; they are borne on stout grooved glabrous or pubescent petioles from one third of an inch to nearly an inch

in length, and before falling in the autumn turn bright scarlet or scarlet and orange. The stipules are linear-obovate or linear-lanceolate, brown and scarious and coated with pale hairs, those of the last leaves of the season often remaining on the branch during the following winter. The flowers appear during March and April with the unfolding of the leaves, or when they are about a third grown. The staminate flowers are produced in slender hairy aments from four to six inches in length; the calyx is light yellow covered on the outer surface with pale hairs and divided into acute segments; the anthers are acute, glabrous, and yellow. The pistillate flowers are sessile or pedunculate, and are covered, as are their stalks, with long thick pale tomentum. The acorns are sessile or are often borne on slender pubescent peduncles marked with pale lenticels and sometimes an inch or an inch and a half in length; the nut varies in shape from subglobose to ovate or rarely to ovate-oblong, and from half an inch to nearly an inch in length, and usually its breadth at the base is greater than its length; it is light chestnut-brown and covered at the apex and often on the sides also with short pale pubescence; the cup is ovate or rarely deeply cup-shaped or nearly spherical, and almost or entirely incloses the nut, or rarely only its lower half; it is thin and woody, bright red-brown and pubescent on the inner surface and hoary-tomentose on the outer, which is covered by ovate united scales produced into free acute tips; these are usually much thickened and contorted at the base of the cup, and, gradually growing thinner above, form a ragged edge to its thin and often irregularly split margin.[1]

Quercus lyrata inhabits river-swamps or small deep depressions in rich bottom-lands often filled with water and usually wet throughout the year, and is distributed from the valley of the Patuxent River in southern Maryland[2] southward near the coast to western Florida, through the Gulf states to the valley of the Trinity River in Texas, through Arkansas[3] and southwestern Missouri, where, in a swamp near Allenton, there is a single specimen, the most northern known representative of the species west of the Mississippi River, to central Tennessee, southern Indiana, and Jasper County, Illinois.[4] Rare in the Atlantic and eastern Gulf states, it is most common and grows to its largest size in the valley of the Red River in Louisiana and the adjacent parts of Texas and Arkansas; and in southern Illinois on the swampy bottom-lands of the Fox River it is the prevailing species of the forest.

The wood of *Quercus lyrata* is heavy, hard, strong, tough, and very durable in contact with the ground, but is rather liable to check in seasoning. It contains broad conspicuous medullary rays and bands of from one to three rows of large open ducts marking the layers of annual growth, and is rich dark brown, with thick lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.8313, a cubic foot weighing 51.81 pounds. Commercially it is confounded with the wood of *Quercus alba*, and is used for the same purposes.

Although introduced into English plantations by John Fraser[5] as early as 1786,[6] *Quercus lyrata* is still little known in cultivation. It is well established, however, in the Arnold Arboretum, proving perfectly hardy in the climate of eastern Massachusetts.

[1] It is only from trees found by Dr. Charles Mohr in December, 1880, on Peyton's Creek, Matagorda County, Texas, that I have seen acorns with deeply cup-shaped cups embracing only from one half to one third of the oblong ovate or oval nut (Plate ccclxxiv. f. 5). The leaves on this tree are oblong-oval, crenately or undulately lobed with small nearly triangular acute or rounded lobes four or five inches in length, thick and firm in texture, dark green on the upper surface and pale and pubescent on the lower (Plate ccclxxiv. f. 8).

[2] *Quercus lyrata* was discovered in Maryland in September, 1890, by Mr. Robert Ridgway. (See *Garden and Forest*, iii. 129.)

[3] Harvey, *Am. Jour. Forestry*, i. 453.

[4] The most northern recorded station of *Quercus lyrata* in Illinois is at Rafe's Mill on the Embarras River in the southeastern corner of Jasper County. (See Ridgway, *Proc. U. S. Nat. Mus.* xvii. 413.)

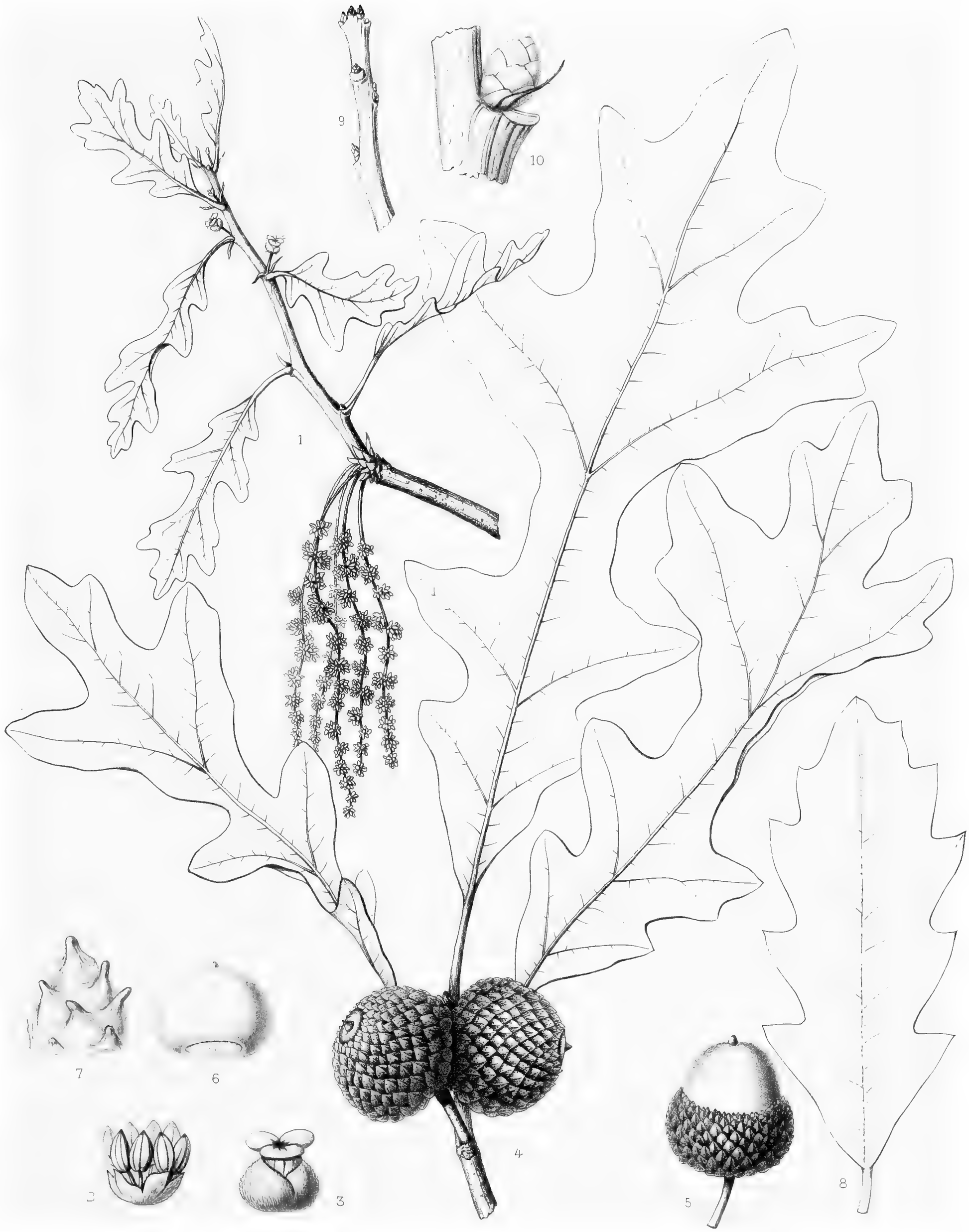
[5] See i. 8.

[6] Aiton, *Hort. Kew.* ed. 2, v. 295. — Loudon, *Arb. Brit.* iii. 1871, f. 1733, 1734.

EXPLANATION OF THE PLATE.

PLATE CCCLXXIV. QUERCUS LYRATA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A fruit, natural size.
6. A nut, natural size.
7. Part of the base of a cup, enlarged.
8. A leaf, natural size.
9. A winter branchlet, natural size.
10. An axillary winter-bud with persistent stipule, enlarged.



C.E. Faxon del.

Lebrun sc.

QUERCUS LYRATA, Walt.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

QUERCUS PRINUS.

Chestnut Oak. Rock Chestnut Oak.

LEAVES obovate or oblong to lanceolate-acuminate, coarsely crenately toothed with rounded or acute teeth.

Quercus Prinus, Linnæus, *Spec.* 995 (1753). — Miller, *Dict.* ed. 8, No. 9. — Muenchhausen, *Hausv.* v. 252. — Du Roi, *Harbk. Baumz.* ii. 276, t. 6, f. 3. — Wangenheim, *Beschreib. Nordam. Holz.* 58; *Nordam. Holz.* 15, t. 4, f. 8. — Lamarck, *Dict.* i. 720. — Moench, *Bäume Weiss.* 94; *Meth.* 348. — Evelyn, *Silva*, ed. Hunter, i. 69. — Willdenow, *Berl. Baumz.* 271; *Spec.* iv. pt. i. 439; *Enum.* 975. — Smith & Abbot, *Insects of Georgia*, ii. 163, t. 82. — Muehlenberg & Willdenow, *Neue Schrift. Gesell. Nat. Fr. Berlin*, iii. 397. — Persoon, *Syn.* ii. 568. — Desfontaines, *Hist. Arb.* ii. 509. — Stokes, *Bot. Mat. Med.* iv. 407. — Nuttall, *Gen.* ii. 215. — *Nouveau Duhamel*, vii. 164. — Hayne, *Dendr. Fl.* 155. — Sprengel, *Syst.* iii. 859. — Audubon, *Birds*, t. 50, 131. — Spach, *Hist. Vég.* xi. 157. — Dietrich, *Syn.* v. 308. — Darlington, *Fl. Cestr.* ed. 3, 267. — Chapman, *Fl.* 423. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 67. — Koch, *Dendr.* ii. pt. ii. 48. — Engelmann, *Trans. St. Louis Acad.* iii. 390. — Lauche, *Deutsche Dendr.* 294. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 142. — Houba, *Chênes Am. en Belgique*, 279, t. — Mayr, *Wald. Nordam.* 145, t. 2. — Watson & Coulter, *Gray's Man.* ed. 6, 476. — Koehne, *Deutsche Dendr.* 127. — *Gard. Chron.* ser. 3, xiv. 616, f. 101.

Quercus Prinus, α **lata**, Aiton, *Hort. Kew.* iii. 356 (1789).

? Quercus Prinus, β **oblongata**, Aiton, *Hort. Kew.* iii. 356 (1789).

Quercus Prinus (Monticola), Michaux, *Hist. Chênes Am.* No. 5, t. 7 (1801); *Fl. Bor.-Am.* ii. 196. — Michaux f. *Hist. Arb. Am.* ii. 55, t. 8. — Spach, *Hist. Vég.* xi. 158. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 34. — Chapman, *Fl.* 424. — A. de Candolle, *Prodr.* xvi. pt. ii. 21. — Gray, *Man.* ed. 5, 451. — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 339, t. 4. — Bailey, *Am. Nat.* xiv. 892, f. 1–4. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 179. — Dippel, *Handb. Laubholzk.* ii. 85.

Quercus montana, Willdenow, *Spec.* iv. pt. i. 440 (1805); *Enum.* 975; *Berl. Baumz.* ed. 2, 340. — Persoon, *Syn.* ii. 569. — Pursh, *Fl. Am. Sept.* ii. 634. — Nuttall, *Gen.* ii. 216. — *Nouveau Duhamel*, vii. 165, t. 47, f. 2. — Hayne, *Dendr. Fl.* 156. — Elliott, *Sk.* ii. 609. — Bigelow, *Fl. Boston.* ed. 2, 352. — Sprengel, *Syst.* iii. 860. — Emerson, *Trees Mass.* 138, t. 6; ed. 2, i. 156, t. — Torrey, *Fl. N. Y.* ii. 192. — Gray, *Man.* 414. — Darlington, *Fl. Cestr.* ed. 3, 266. — Dietrich, *Syn.* v. 308. — Lauche, *Deutsche Dendr.* 294.

Quercus Castanea, Emerson, *Trees Mass.* 137, t. 5 (not Née nor Willdenow) (1838); ed. 2, i. 155, t.

? Quercus Prinus, α **parvifolia**, Dippel, *Handb. Laubholzk.* ii. 85, f. 35 (1892).

A tree, usually sixty or seventy or occasionally one hundred feet in height, with a trunk three or four, or rarely six or seven, feet in diameter, divided, generally fifteen or twenty feet above the surface of the ground, into large limbs which spread into a broad rather open irregular head; or on dry exposed mountain-slopes often not more than twenty or thirty feet tall, with a trunk from eight to twelve inches in diameter. The bark of young stems and small branches is thin, smooth, purplish brown, and often lustrous, and on old trunks and large limbs it is from three quarters of an inch to an inch and a half in thickness, dark reddish brown or nearly black, and divided into broad rounded longitudinal ridges separating on the surface into small closely appressed scales. The branchlets are stout and marked with scattered pale lenticels, and when they first appear are green tinged with purple or bronze-color and glabrous, or pilose with long pale hairs; during their first winter they vary from light orange-color to reddish brown, and in their second year become dark gray or brown. The buds are ovate, acute or acuminate, from one quarter to one half of an inch in length, and are covered with light chestnut-brown scales more or less pilose toward the apex, and ciliate on the margins with pale hairs. The leaves are convolute in the bud, obovate or oblong to lanceolate, gradually or abruptly wedge-shaped, or rounded or subcordate at the narrowed base, acute, or acuminate with short or elongated pointed or rounded tips, or rounded at the apex, and regularly and coarsely crenulate-toothed, except

toward the base, with rounded or acute sometimes nearly triangular oblique teeth, or rarely obscurely sinuately toothed with oblong rounded teeth; when they unfold they are orange-green or bronze-red and very lustrous on the upper surface, which is glabrous with the exception of the slightly pilose midribs, and on the under surface are green and coated with soft pale pubescence; at maturity they are thick and firm or subcoriaceous, yellow-green and rather lustrous above, and paler and covered with fine pubescence below, with stout yellow midribs slightly impressed on the upper side and conspicuous primary veins which run to the points of the teeth or fork before reaching the margins and are connected by rather conspicuous reticulate veinlets; they are from four and a half to nine inches in length and from an inch and a half to three inches and a half in width, those near the bottom of the tree being often much broader than those on fertile upper branches; they are borne on stout or slender petioles varying from half an inch to an inch in length, and fall in the autumn after turning a dull orange-color or rusty brown. The stipules are linear-obovate to lanceolate, scarious, hirsute, green below, brown above the middle, from one half to three quarters of an inch long, and caducous. The flowers appear in May and June, when the leaves are about a third grown, and are borne, the staminate in elongated hirsute aments, and the pistillate in short spikes on stout puberulous dark green peduncles marked with pale lenticels. The calyx of the staminate flower is light yellow, pilose and deeply divided usually into from seven to nine narrow acute segments scarious and reddish brown toward the margins and tipped with clusters of pale hairs; the stamens equal its divisions in number and are composed of slender light yellow glabrous filaments and oblong bright yellow glabrous emarginate anthers. The involucral scales of the pistillate flower are coated with pale hairs; the stigmas are dark red. The acorns are borne on short stout stems, singly or often in pairs; the nut is oval or ovate, rounded and rather obtuse or pointed at the apex, bright chestnut-brown, very lustrous, from an inch to an inch and a half in length, and from five eighths of an inch to nearly an inch in breadth; the cup, which incloses about half the nut or sometimes only its base, is cup-shaped or turbinate, thin, light brown and pubescent on the inner surface, and reddish brown and hoary-pubescent on the outer surface, which is roughened or tuberculate, especially toward the base; the scales are rather small, with a thickened and knob-like base, small thin nearly triangular free light brown tips, and are minute near the rim of the cup.

Quercus Prinus is an Appalachian tree, and grows on hillsides and the high rocky banks of streams in rich and deep or sometimes in shallow and comparatively sterile soil. Inhabiting the banks of the Saco River and Mount Agamenticus on the coast of southern Maine,[1] and the slopes of the Blue Hills in eastern Massachusetts, it ranges southward to Delaware and the District of Columbia[2] and along the mountains to northern Georgia and Alabama, and westward to the shores of Lake Champlain and the valley of the Genesee River in New York, and to the northern shores of Lake Erie, where it is found from the Niagara River to Amherstburg,[3] and to central Kentucky and Tennessee. Rare and local in New England and Ontario, it is abundant on the banks of the lower Hudson River and on all the Appalachian hills from southern New York to Alabama, and is most common and attains its largest size on the lower slopes of the mountains of the Carolinas and Tennessee, where, on dry hills, it often forms a large part of the forest growth.

The wood of *Quercus Prinus* is heavy, hard, strong, rather tough, close-grained, although difficult to season, and durable in contact with the soil; it is dark brown, with thin lighter colored sapwood, and contains broad conspicuous medullary rays and large open ducts marking the layers of annual growth. The specific gravity of the absolutely dry wood is 0.7499, a cubic foot weighing 46.73 pounds. It is largely used in fencing, for railway ties, and for fuel.

[1] Emerson, *Trees Mass.* 137.

Although *Quercus Prinus* was collected by William Oakes on Mount Agamenticus, where it was found by Emerson, who also saw it farther north on the Saco River, the fact of its occurrence in Maine has generally been overlooked by subsequent writers on the American flora.

[2] L. F. Ward, *Bull. U. S. Nat. Mus.* No. 22, 113 (*Fl. Washington*).

[3] Macoun, *Cat. Can. Pl.* 442.

The bark, which is rich in tannin and is considered more valuable than that of other American White Oaks, is consumed in large quantities for tanning leather.[1]

Quercus Prinus was one of the first American Oaks known to Europeans. Mentioned by Ray in 1688 in the *Historia Plantarum*,[2] it was first figured and described by Plukenet in his *Phytographia*[3] three years later, and, according to Aiton,[4] was cultivated in English gardens in 1730.

Few of the Oaks of eastern America surpass this species in the beauty of strength and vigor; it often grows to a venerable age,[5] and, always an interesting and handsome object, is perhaps most attractive in the hazy light of a warm autumn day, when the sunlight, flickering through the branches, illumines its dusky stem and yellow leaves.

[1] Trimble, *The Tannins*, ii. 15, f. 3–5.

[2] *Quercus Virginiana Castaneæ folio*, ii. 1801. — Breyne, *Prodr.* ed. 1739, 93.

[3] *Quercus castaneæ foliis procera arbor Virginiana*, t. 54, f. 3; *Alm. Bot.* 309.

Quercus foliis obverse ovatis utrinque acuminatis serratis: denticulis rotundatis uniformibus, Linnæus, *Hort. Cliff.* 448. — Clayton, *Fl. Virgin.* 117. — Royen, *Fl. Leyd. Prodr.* 80.

The early description of the Chestnut Oak might apply as well to the Swamp Chestnut Oak (*Quercus Michauxii*) as to this species, which does not grow near the coast of Virginia, where, however, the Swamp Chestnut Oak is common, and may have been the first of the Chestnut Oaks noticed by Europeans.

[4] *Hort. Kew.* iii. 356. — Loudon, *Arb. Brit.* iii. 1873, f. 1736 (*Quercus Prinus Monticola*).

[5] One of the most interesting Oak-trees in the United States is a Chestnut Oak standing on the banks of the Hudson River, at Presqu'ile, near Fishkill-on-the-Hudson, under which Washington in 1782 and 1783 used to mount his horse when he went from his headquarters on the west bank of the Hudson to the army encamped at Fishkill. This tree, which is still in vigorous condition, although its companion was blown down several years ago, has a trunk diameter of seven feet, and is believed to be several hundred years old, as a century ago it was already famous for its size and age (*Garden and Forest*, i. 511, f. 81).

EXPLANATION OF THE PLATES.

Plate CCCLXXV. Quercus Prinus.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate inflorescence, enlarged.
4. A pistillate flower, enlarged.
5. A leaf, natural size.

Plate CCCLXXVI. Quercus Prinus.

1. A fruiting branch, natural size.
2. A cup, natural size.
3. Vertical section of a nut, natural size.
4. A seed, natural size.
5. Part of the base of a cup, enlarged.
6. A winter branchlet, natural size.

C.E. Faxon del. Rapine sc.

QUERCUS PRINUS, L.

A. Riocreux direx.t Imp. J. Taneur, Paris.

C.E. Faxon del. *Rapine sc.*

QUERCUS PRINUS. L

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

QUERCUS ACUMINATA.

Yellow Oak. Chestnut Oak.

LEAVES oblong or lanceolate, acute or acuminate, or broadly obovate, equally sinuately toothed, puberulous, pale, and often silvery white on the lower surface.

Quercus acuminata, Sargent, *Garden and Forest*, viii. 93 (1895).

Quercus Prinus acuminata, Michaux, *Hist. Chênes Am.* No. 5, t. 8 (1801); *Fl. Bor.-Am.* ii. 196. — Michaux f. *Hist. Arb. Am.* ii. 61, t. 9. — *Nouveau Duhamel*, vii. 167. — Gray, *Man.* ed. 5, 451. — A. de Candolle, *Prodr.* xvi. pt. ii. 21. — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 339. — Houba, *Chênes Am. en Belgique*, 284.

Quercus Castanea, Willdenow, *Muehlenberg & Willdenow Neue Schrift. Gesell. Nat. Fr. Berlin*, iii. 396 (not Née) (1801); *Spec.* iv. pt. i. 441; *Enum.* 976; *Berl. Baumz.* ed. 2, 341. — Persoon, *Syn.* ii. 569. — Bosc, *Mém. Inst. Nat. Sci. Phys. Math.* viii. pt. i. 341. — Stokes, *Bot. Mat. Med.* iv. 407. — Pursh, *Fl. Am. Sept.* ii. 634. — Poiret, *Lam. Dict.* Suppl. ii. 219. — Nuttall, *Gen.* ii. 216. — Hayne, *Dendr. Fl.* 156. — Elliott, *Sk.* ii. 610. — Sprengel, *Syst.* iii. 860. — Spach, *Hist. Vég.* xi. 158. — Torrey, *Fl. N. Y.* ii. 193. — Gray, *Man.* 416. — Darlington, *Fl. Cestr.* ed. 3, 267. — Brendel, *Trans. Ill. Agric. Soc.* iii. 619, t. 4. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 34. — Chapman, *Fl.* 424. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 68; *Liebmann Chênes Am. Trop.* t. H, K, 33, f. 31, 32. — Vasey, *Am. Ent. and Bot.* ii. 281, f. 173. — Dippel, *Handb. Laubholzk.* 86, f. 36. — Koehne, *Deutsche Dendr.* 127.

Quercus Muehlenbergii, Engelmann, *Trans. St. Louis Acad.* iii. 391 (1877). — Britton, *Bull. Torrey Bot. Club*, xiii. 40.

Quercus prinoides, Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 142 (in part) (not Willdenow) (1884). — Mayr, *Wald. Nordam.* 145, t. 1, 2.

A tree, from eighty to one hundred or occasionally one hundred and sixty feet in height, with a tall straight trunk three or four feet in diameter above the broad and often buttressed base and comparatively small branches which form a shapely narrow round-topped head; or east of the Alleghany Mountains and on dry hills often not more than twenty or thirty feet tall. The bark of the trunk is rarely more than half an inch in thickness and is broken on the surface into thin loose silvery gray or nearly white scales, sometimes slightly tinged with brown. The branchlets are slender and marked with scattered pale lenticels, and when they first appear are green, more or less tinged with red or purple, and pilose with scattered pale hairs; during their first winter they are light orange-colored or reddish brown, and, gradually growing darker, become dark brown or orange-colored in their second year, and ultimately gray or brown. The buds are ovate, acute, from an eighth to nearly a quarter of an inch in length, and covered with chestnut-brown scales white and scarious on the margins. The leaves, which are usually crowded at the ends of the branches, are convolute in the bud, oblong or lanceolate or broadly obovate, abruptly or gradually narrowed and wedge-shaped or slightly narrowed and rounded or cordate at the base, acute, or acuminate at the apex with long and narrow or with short and broad points, equally serrate except at the base, the teeth, which are acute and often inflexed or broad and rounded, being tipped with small glandular mucros; or the leaves are rarely slightly undulate; when they unfold they are bright bronzy green and puberulous on the upper surface, and tinged with purple, and coated on the lower with pale tomentum which soon disappears, leaving in the axils of the veins tufts of pale hairs which are very conspicuous when the leaves are about half grown; at maturity they are thick and firm in texture, light yellow-green above, pale, often silvery white, and coated with short fine pubescence below, from four to seven inches long, and from one to five inches broad, with stout yellow midribs impressed on the upper side, and conspicuous primary veins running obliquely to the points of the teeth and connected by reticulate cross veinlets; they are borne on slender nearly terete or slightly flattened petioles varying from three quarters of an inch to an inch and a half in length, and in the

autumn, before falling, turn orange-color and scarlet.[1] The stipules are linear-obovate or lanceolate, pilose, brown and scarious, and caducous. The aments of staminate flowers are three or four inches long, with slender yellow-green pilose stems, and, appearing with the unfolding of the leaves, do not fall until they are nearly half grown; the calyx is light yellow, hairy, and deeply divided into lanceolate ciliate segments; the anthers are oblong, slightly emarginate, yellow, and glabrous. The pistillate flowers, which are sessile or borne in short spikes, are coated, like their peduncles, with thick white tomentum; the stigmas are bright red. The fruit is sessile or raised on a short stout peduncle, and is solitary or often in pairs; the nut is broadly ovate or oval, narrowed and rounded at the pubescent apex, from half an inch to nearly an inch in length, light chestnut-brown, and contains a sweet sometimes edible seed; the cup, which embraces about half the nut, is cup-shaped, thin, light brown and pubescent on the inner, and hoary-tomentose on the outer surface, which is covered with small obtuse scales, more or less thickened and rounded on the back toward the base of the cup, the small free red-brown points of the upper ranks forming a minute fringe-like border to its rim.[2]

Quercus acuminata is distributed from Gardner's Island, in Lake Champlain, and the banks of the Hudson River north of the city of Newburgh, westward through southern Ontario[3] to southeastern Nebraska[4] and eastern Kansas,[5] and southward in the Atlantic states to the District of Columbia[6] and the valley of the upper Potomac River and, west of the Alleghany Mountains, to central Alabama and Mississippi, and through Arkansas[7] and northern Louisiana to the eastern borders of the Indian Territory and to the valley of the Nueces River in Texas, reaching the western limits of its range in the cañons of the Guadaloupe Mountains in the extreme western part of this state.[8] Rare and comparatively local in the Atlantic states, where it is usually found on limestone soil, it is exceedingly abundant in the Mississippi basin, growing on limestone ridges or sometimes on dry flinty hills and on deep rich bottom lands and the rocky banks of streams, and probably attains its largest size on the bottoms of the lower Wabash River and its tributaries in southern Indiana and Illinois.[9]

The wood of *Quercus acuminata* is heavy, hard, very strong, close-grained, and durable in contact with the soil, but liable to check badly in drying. It is dark brown, with thin light-colored sapwood, and contains broad conspicuous medullary rays and bands of small open ducts marking the layers of annual growth. The specific gravity of the absolutely dry wood is 0.8605, a cubic foot weighing 53.63 pounds. It is largely used in cooperage and the manufacture of wheels, for fencing, and for railway ties.

Its tall straight stem, its pale and often snow-white bark, and its long leaves hanging close to the branches or fluttering on their slender stalks with the faintest breeze, now yellow-green and then silvery

[1] In the Atlantic states the leaves of this tree are usually oblong-lanceolate and long-acuminate, with sharp often inflexed teeth, and are from four to six inches in length and from one to two inches in width. West of the Alleghany Mountains, especially when growing on deep rich bottom-lands, it produces, even on fertile branches, broader obovate mostly short-pointed and larger leaves with broad, rounded teeth. Such leaves, while they resemble in outline those of *Quercus Prinus*, can be distinguished from them by the presence of the glandular tips on the teeth. Ovate acute leaves, rounded at the broad bases with only slightly undulate glandular margins, were found in 1879 near the Chain Bridge, in the District of Columbia, by L. F. Ward, whose specimens are preserved in the National Herbarium.

[2] A tree found by Mr. E. J. Hill at Robey, Indiana, in 1892, is possibly a hybrid between *Quercus acuminata* and *Quercus macrocarpa*. The leaves are oblong or slightly obovate, acute, dark green and lustrous on the upper surface, and silvery white and pubescent on the lower. Some individuals are regularly sinuately lobed with small acute or rounded gland-tipped lobes, and others are deeply divided in the middle by a pair of broad oblique sinuses, the upper half of the leaf being sinuately lobed and the lower divided into two pairs of narrow acute and usually entire lobes. The fruit is short-stalked, with an oval pilose nut half an inch long, inclosed to the acute apex in a deep cup-shaped cup, with the hoary basal scales of *Quercus macrocarpa*, but without its marginal fringe.

[3] Macoun, *Cat. Can. Pl.* 442.

[4] Bessey, *Rep. State Board Agric. Nebraska*, 1894, 110 (*Quercus prinoides*).

[5] Mason, *Eighth Bienn. Rep. State Board Agric. Kansas*, 272; *Garden and Forest*, iv. 508.

[6] L. F. Ward, *Bull. U. S. Nat. Mus.* No. 22, 113 (*Fl. Washington*).

[7] Harvey, *Am. Jour. Forestry*, i. 454.

According to Professor Harvey, *Quercus acuminata* is also called in Arkansas Chinquapin Oak, Pin Oak, and Rock Oak.

[8] Havard, *Proc. U. S. Nat. Mus.* viii. 105.

[9] Ridgway, *Proc. U. S. Nat. Mus.* v. 82; xvii. 415.

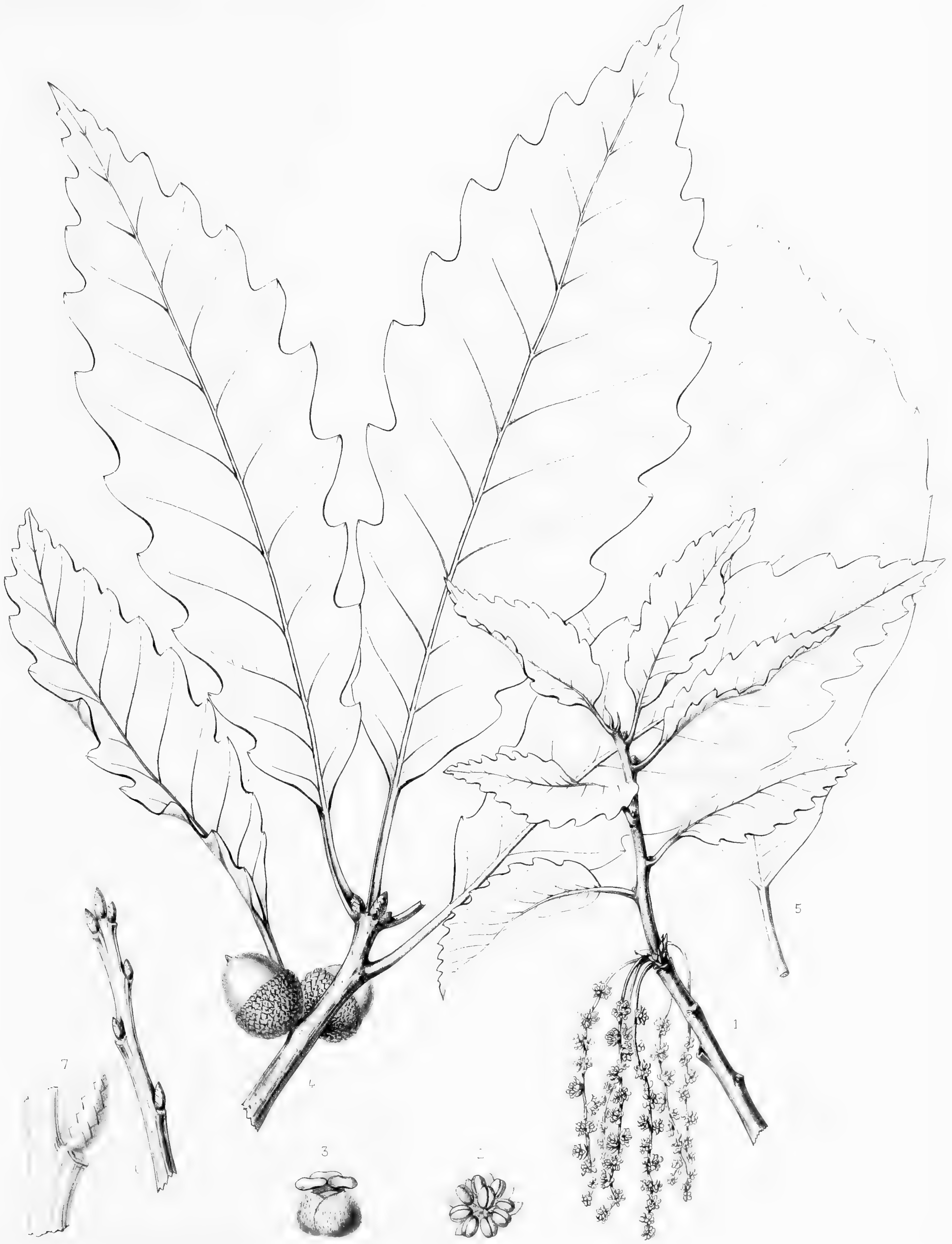
white as first the upper and then the lower surface is turned to the eye, make the Yellow Oak one of the most beautiful trees of the regions in which it attains its finest development. Little known in cultivation, although it is said to have been planted in England in 1822,[1] the Yellow Oak is well worthy of a place in the parks and pleasure-grounds of the eastern United States.

[1] Loudon, *Arb. Brit.* iii. 1875, f. 1637.

EXPLANATION OF THE PLATE.

Plate CCCLXXVII. Quercus acuminata.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A leaf, natural size.
6. A winter branchlet, natural size.
7. An axillary winter-bud, enlarged.



C. E. Faxon del. *Himely sc.*

QUERCUS ACUMINATA, Sarg.

A. Riocreux direx. *Imp. J. Taneur, Paris.*

QUERCUS PRINOIDES.

Chinquapin Oak.

LEAVES usually obovate-oblong, wedge-shaped at the base, undulate-toothed with rounded or acute teeth, soft-pubescent and often silvery white on the lower surface.

Quercus prinoides, Willdenow, *Muehlenberg & Willdenow Neue Schrift. Gesell. Nat. Fr. Berlin*, iii. 397 (1801); *Spec.* iv. pt. i. 440. — Persoon, *Syn.* ii. 568. — Poiret, *Lam. Dict.* Suppl. ii. 219. — *Nouveau Duhamel*, vii. 166. — Torrey, *Fl. N. Y.* ii. 193, t. 109. — Darlington, *Fl. Cestr.* ed. 3, 267. — Dietrich, *Syn.* v. 309. — Chapman, *Fl.* 424. — Vasey, *Am. Ent. and Bot.* ii. 281, f. 174. — Koch, *Dendr.* ii. pt. ii. 49. — Engelmann, *Trans. St. Louis Acad.* iii. 391. — Watson & Coulter, *Gray's Man.* ed. 6, 476. — Dippel, *Handb. Laubholzk.* ii. 83, f. 34.

Quercus Prinus humilis, Marshall, *Arbust. Am.* 125 (not *Quercus humilis*, Lamarck) (1785). — Castiglioni, *Viag. negli Stati Uniti*, ii. 346. — Gray, *Man.* ed. 5, 452.

Quercus Prinus (pumila), Michaux, *Hist. Chênes Am.* No. 5, t. 9, f. 1 (not *Quercus pumila*, Walter) (1801); *Fl. Bor.-Am.* ii. 196.

Quercus Prinus Chincapin, Michaux f. *Hist. Arb. Am.* ii. 64, t. 10 (1812). — A. de Candolle, *Prodr.* xvi. pt. ii. 21. — Wesmael, *Bull. Féd. Hort. Soc. Belg.* 1869, 339. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 180.

Quercus Chinquapin, Pursh, *Fl. Am. Sept.* ii. 634 (1814). — Nuttall, *Gen.* ii. 216. — Elliott, *Sk.* ii. 611. — Darlington, *Fl. Cestr.* ed. 2, 536. — Emerson, *Trees Mass.* 140; ed. 2, i. 158, t. — Bigelow, *Fl. Boston.* ed. 3, 377.

Quercus Muehlenbergii, var. **humilis**, Britton, *Bull. Torrey Bot. Club*, xiii. 41 (1886).

A shrub, spreading into broad clumps by vigorous prolific stolons, with slender stems usually from two to four feet in height; or occasionally, in the east, from twelve to fifteen feet tall, and in the prairie regions of Missouri and Kansas sometimes almost tree-like in habit, with trunks covered with pale scaly bark, often four or five inches in diameter and from ten to fifteen feet in height. The branchlets are slender and marked with conspicuous pale lenticels, which persist for many years, and when they first appear are dark green tinged with red and covered with pale scurfy caducous pubescence; during their first winter they are orange or reddish brown, and, becoming brown tinged with red in their second year, they ultimately turn dark brown. The buds are ovate or subglobose, and obtuse or slightly narrowed at the apex, about an eighth of an inch in length, and covered with light chestnut-brown scales thin and scarious on the margins. The leaves are convolute in the bud, ovate-oblong or rarely oblong, usually gradually narrowed and wedge-shaped, or rarely rounded at the broader entire base, acute or acuminate at the apex, coarsely undulate-toothed with equal acute incurved or with broad rounded teeth tipped with small glandular mucros; when they unfold they are orange-red and puberulous, or pilose with short pale hairs on the upper surface, red and coated on the lower with thick silvery white tomentum, and furnished at the points of the teeth with large dark glands, and at maturity they are thin and firm, dark yellow-green and rather lustrous above, coated with soft fine pubescence and silvery white or rarely light green below, from three to six inches in length and from an inch to three and a half inches in breadth, with slender narrow yellow midribs, primary veins running obliquely to the points of the teeth, and conspicuous reticulate cross veinlets; they are borne on stout glabrous or puberulous petioles grooved and flattened on the upper side and from one quarter to three quarters of an inch in length, and in the autumn turn bright orange and scarlet before falling. The stipules are obovate or linear lanceolate, red above the middle, coated with pale hairs, from one half to three quarters of an inch long, soon becoming brown and scarious, and caducous. The flowers open in May, when the leaves are nearly a third grown, and are borne, the staminate in hirsute aments from an inch and a half to two inches and a half in length, the pistillate on short peduncles clothed, like their invo-

lucral scales, with dense silvery white tomentum. The calyx of the pistillate flower is light yellow-green, coated with pale hairs on the outer surface, and divided into from five to nine acute segments ending in tufts of rusty hairs and shorter than the stamens, which are composed of slender elongated filaments and emarginate yellow glabrous anthers. The stigmas are bright red. The acorns, which are produced in the greatest profusion, covering the branches in favorable seasons with abundant crops, are sessile or are borne on short stout orange-brown stalks; the nut is oval, rounded and obtuse at the apex, which is covered with white pubescence, light chestnut-brown and lustrous, from one half to three quarters of an inch in length and from one third to nearly one half of an inch in breadth, with a sweet seed; the cup, which embraces from one half to two thirds of the nut, is thin, deeply cup-shaped, light brown and pubescent on the inner surface, and hoary with pale tomentum on the outer surface, which is covered with loosely imbricated ovate acute scales usually considerably thickened on the back toward the base of the cup and ending in small acute reddish brown tips.

Quercus prinoides inhabits rocky slopes and hillsides, or, west of the Mississippi River, sometimes low undulating prairies, and is distributed from Essex County, Massachusetts, to North Carolina,[1] and westward to southeastern Nebraska,[2] central Kansas,[3] the Indian Territory, and eastern Texas.[4] First described by Plukenet in 1696,[5] this pretty shrub was, according to Loudon,[6] introduced into English gardens in 1823.

[1] Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 35.

[2] Bessey, *Rep. State Board Agric. Nebraska*, 1894, 110.

[3] Mason, *Eighth Bienn. Rep. State Board Agric. Kansas*, 272.

[4] Coulter, *Contrib. U. S. Nat. Herb.* ii. 415 (*Man. Pl. W. Texas*).

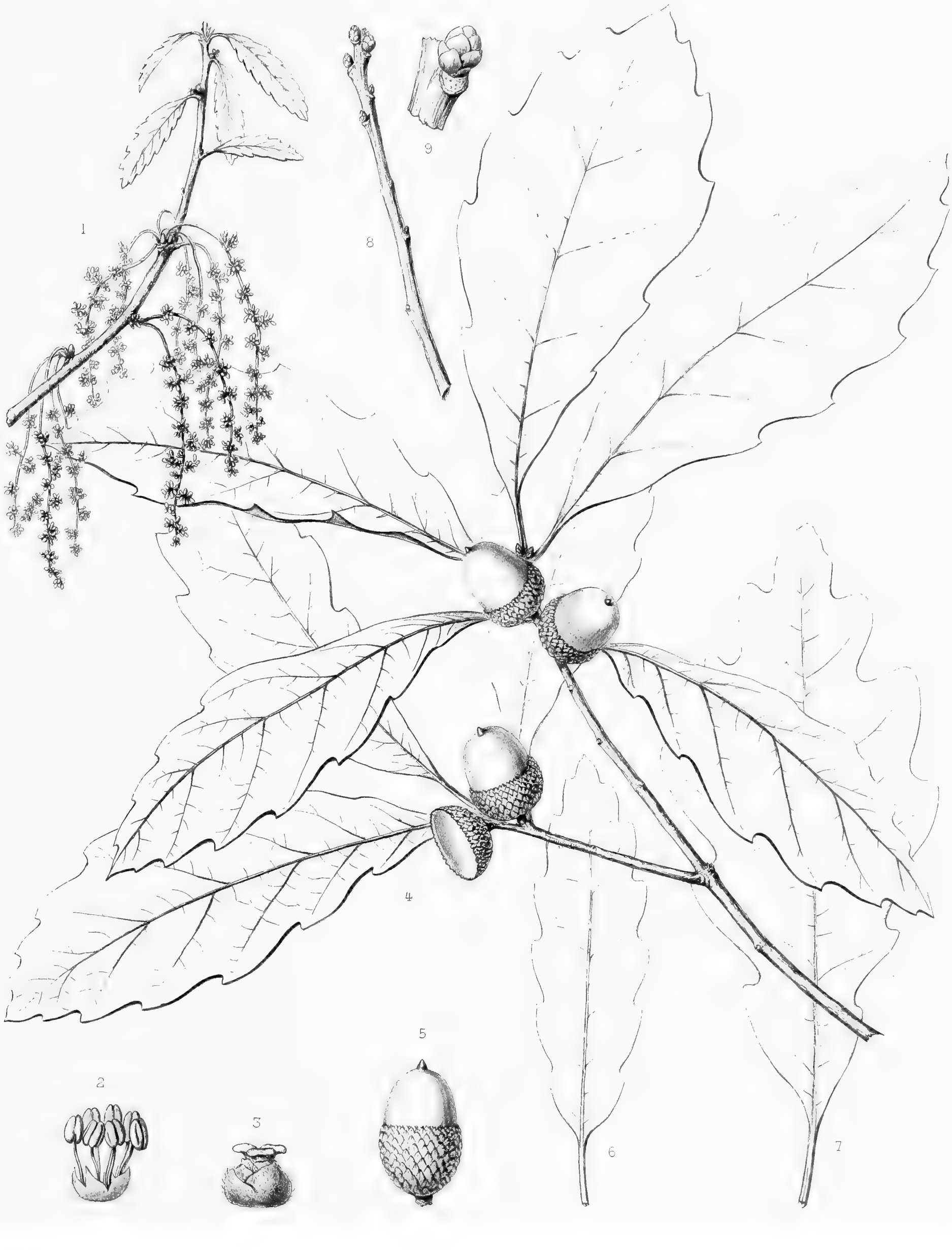
[5] *Quercus pumilis Castaneæ folio Virginiensis*, The Chinquapin Oak, *Alm. Bot.* 309. — Duhamel, *Traité des Arbres*, ii. 203.

[6] *Arb. Brit.* iii. 1875, f. 1738.

EXPLANATION OF THE PLATE.

Plate CCCLXXVIII. Quercus prinoides.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A fruit, natural size.
6. A leaf, natural size.
7. A leaf, natural size.
8. A winter branchlet, natural size.
9. An axillary winter-bud, enlarged.



C.E. Faxon del.

Monniés sc.

QUERCUS PRINOIDES, Willd.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

QUERCUS SADLERIANA.

LEAVES oval to obovate, coarsely denticulate, thick and coriaceous, pale and usually puberulous on the lower surface, persistent during the winter.

Quercus Sadleriana, R. Brown Campst. *Ann. and Mag. Nat. Hist.* ser. 2, vii. 249 (1871). — Watson, *Proc. Am. Acad.* xxii. 477. — Greene, *West Am. Oaks*, 46.

A shrub, with slender ashy gray stems from three to six feet tall, forming large thickets. The branchlets are stout and marked with oblong scattered pale lenticels; when they first appear they are green tinged with red and glabrous or pilose with occasional caducous pale hairs, and during their first winter they are light orange-colored or light reddish brown, becoming ashy gray in their second or third year. The buds are ovate, obtuse, bright red-brown, covered with loose pale hairs, and from one quarter to one third of an inch in length, the scales of the inner ranks being coated with thick white tomentum. The leaves are convolute in the bud, oval or slightly obovate, wedge-shaped or rounded equally or unequally at the narrow base, acute or rounded at the apex, and coarsely dentate with incurved gland-tipped teeth; when they unfold they are thin, bronze-green and puberulous on the upper surface, and pale or silvery white and coated with soft short pubescence on the lower, and at maturity are thick and firm or subcoriaceous, dark yellow-green and lustrous above, and paler, sometimes silvery white, and glabrous or puberulous below; they are from two to four inches in length and from one to two inches in breadth, with slender midribs rounded on the upper side, and simple or rarely forked oblique veins running to the points of the teeth and connected by obscure reticulate cross veinlets; they are borne on stout glabrous grooved petioles varying from half an inch to nearly an inch in length, and, turning yellow in the autumn, remain on the branches until after the appearance of the leaves of the following year. The stipules are obovate, pointed, narrowed into long slender stalks, coated with long loose white tomentum and often nearly an inch long, those of the last leaves being usually persistent on the branches during the winter. The staminate flowers are subtended by linear hairy bracts, and are produced in slender glabrous aments three or four inches in length from the inner scales of the terminal bud and from the axils of the first four or five leaves; the calyx is light yellow, pubescent, and divided into ovate acute lobes much shorter than the stamens, from five to nine in number, which are composed of slender filaments and oblong pointed glabrous yellow anthers. The pistillate flowers are borne in few-flowered spikes on stout peduncles in the axils of the upper leaves, and, like the involucral bracts, are covered with dense pale tomentum; the stigmas are bright red. The acorn is sessile or short-stalked, and usually solitary; the nut is oval, rounded or acute at the apex, about three quarters of an inch long, light chestnut-brown, and slightly puberulous; the cup, which incloses about a third of the nut, is cup-shaped, thin, light brown, and coated with soft white hairs on the inner surface, and reddish brown and tomentose on the outer surface, which is covered by small ovate acute scales with minute free tips, and thick and rounded on the back toward the base of the cup.

Quercus Sadleriana is confined to the high slopes of the mountain ranges of the coast region of southwestern Oregon and northwestern California, forming vast thickets on the Siskiyou Mountains between four and nine thousand feet above the level of the sea.

Discovered in southern Oregon in 1852 or 1853 by John Jeffrey, the Scotch collector, whose specimen of a sterile branch is preserved in the herbarium of the Royal Botanic Garden at Edinburgh, it

remained unknown until its rediscovery by Robert Brown,[1] who, in September, 1865, found it at an elevation of two thousand feet above the level of the sea, close to the California boundary on the Crescent City trail, and published the first description of this beautiful and distinct plant,[2] the only Chestnut Oak of Pacific North America, with which he afterward associated the name of John Sadler,[3] the secretary of the Botanical Society of Edinburgh.

[1] Robert Brown, who affixes Campsteriensis to his name to distinguish himself from the other botanist of the same name, was born in Caithness, Scotland, in 1842, and received the degree of Doctor of Science from the University of Rostock with a thesis on the North American species of Thuya and Libocedrus. From 1861 to 1866 Dr. Brown traveled in America from Venezuela and the West Indies to Alaska and the shores of Behring's Sea. As botanist of the British Columbia Exploring Expedition he visited the then little known interior regions of Vancouver's Island and southern Oregon. Returning to Europe, Dr. Brown traveled in Greenland and in the Barbary States, and has been a lecturer on geology in Scotland and a voluminous writer of popular works of science. In addition to his paper on the North American Thuyas he has published an essay on the geographical distribution of the Coniferæ and Gnetaceæ (*Trans. Bot. Soc. Edinburgh*, x. 175); descriptions of some new and little known species of Oaks from northwestern America (*Ann. and Mag. Nat. Hist.* ser. 2, vii. 249); and *Horæ Sylvanæ*, an incomplete work on the forests of North America.

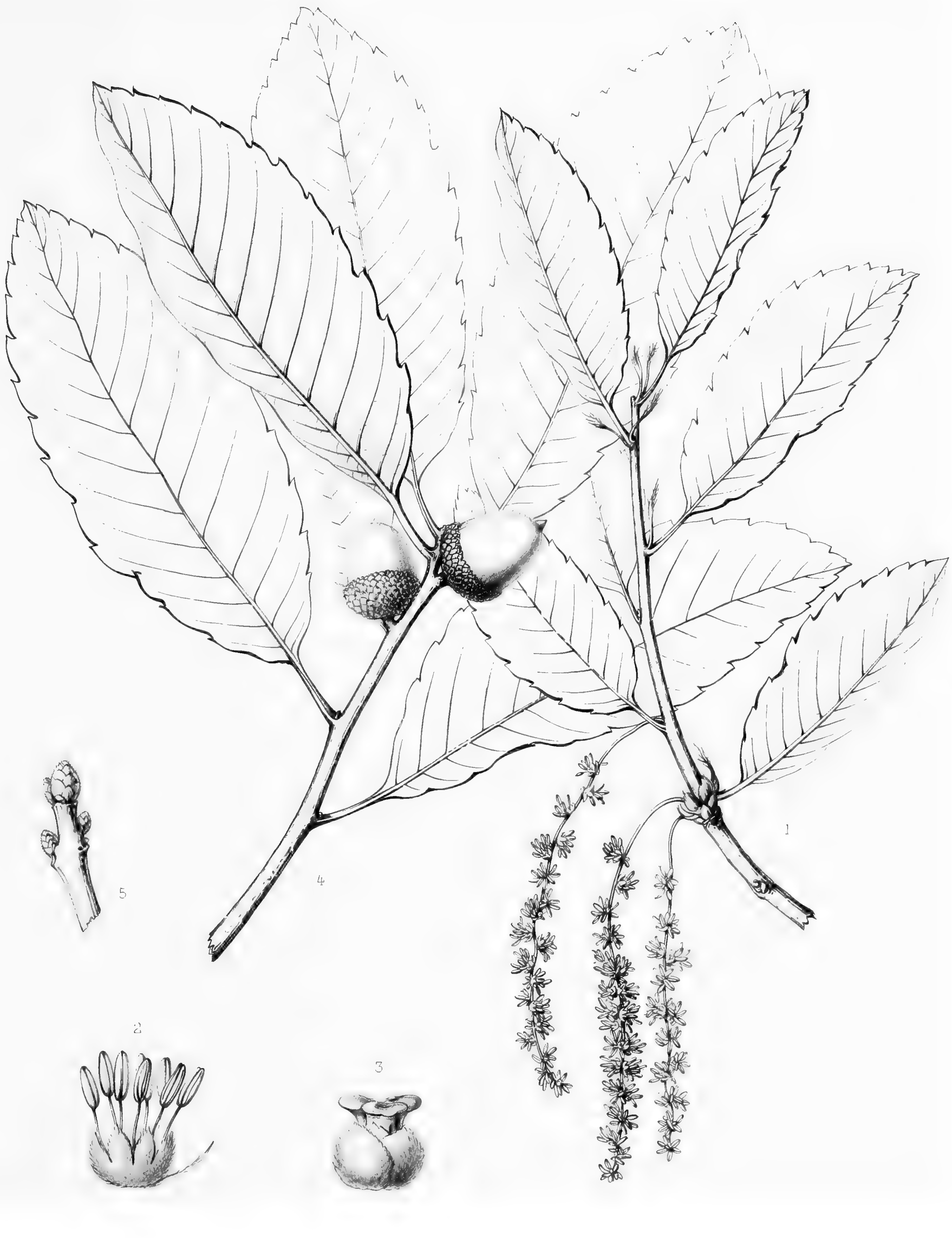
[2] *Quercus sp. nov.* No. 253, *The Farmer*, May 16, 1866.

[3] John Sadler (1837–1882) was born at Gibbleston in Fifeshire, Scotland, and in his infancy was carried to Moncriffe, where his father was gardener to Sir Thomas Moncriffe. Here his early years were spent, and on the completion of his schooling he became his father's assistant. In 1854 he joined the staff of the Edinburgh Botanic Garden, and at the end of a few years was made assistant to Professor Balfour, a position which he filled for nearly a quarter of a century. In 1858 he was chosen assistant secretary of the Botanical Society of Edinburgh, to whose *Transactions* he was a constant contributor, and in 1862 he became secretary of the Scottish Arboricultural Society, interesting himself deeply in its affairs during the remainder of his life, and contributing largely to the success of its work. In 1879 he was made curator of the Edinburgh Botanical Garden. His discoveries of new stations for Scottish plants were numerous, and his name is perpetuated by several species, including a small Willow which he found on the cliffs above Loch Chander. (See Bailey Balfour, *Trans. Bot. Soc. Edinburgh*, xvi. 11.)

EXPLANATION OF THE PLATE.

PLATE CCCLXXIX. QUERCUS SADLERIANA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. End of a branch showing winter-buds, natural size.



C. E. Faxon del. *Migneaux sc.*

QUERCUS SADLERIANA, R. Br. Campst.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

QUERCUS PLATANOIDES.

Swamp White Oak.

LEAVES obovate or oblong-obovate, wedge-shaped at the base, generally coarsely sinuate-dentate or lobed, pubescent and usually hoary on the lower surface.

Quercus platanoides, Sudworth, *Rep. Sec. Agric. U. S.* 1892, 327 (1893).

Quercus Prinus, β platanoides, Lamarck, *Dict.* i. 720 (1783). — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 423.

Quercus alba palustris, Marshall, *Arbust. Am.* 120 (1785). — Castiglioni, *Viag. negli Stati Uniti*, ii. 348. — Muehlenberg & Willdenow, *Neue Schrift. Gesell. Nat. Fr. Berlin*, iii. 395.

Quercus Prinus tomentosa, Michaux, *Hist. Chênes Am.* t. 9 (1801); *Fl. Bor.-Am.* ii. 196. — Loudon, *Arb. Brit.* iii. 1876, f. 1739. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 180.

Quercus bicolor, Willdenow, *Muehlenberg & Willdenow Neue Schrift. Gesell. Nat. Fr. Berlin*, iii. 396 (1801); *Spec.* iv. pt. i. 440. — Persoon, *Syn.* ii. 569. — Bosc, *Mém. Inst. Nat. Sci. Phys. Math.* viii. pt. i. 341. — Poiret, *Lam. Dict.* Suppl. ii. 219. — Pursh, *Fl. Am. Sept.* ii. 633. — Bigelow, *Fl. Boston.* 226. — Nuttall, *Gen.* ii. 215. — *Nouveau Duhamel*, vii. 165. — Sprengel, *Syst.* iii. 860. — Emerson, *Trees Mass.* 135, t. 4; ed. 2, i. 153, t. — Torrey, *Fl. N. Y.* ii. 192. — Dietrich, *Syn.* v. 308. — Darlington, *Fl. Cestr.* ed. 3, 266. — A. de Candolle, *Prodr.* xvi. pt. ii. 20 (excl. syn. *Michauxii*). — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 67. — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 337. — Vasey, *Am. Ent. and Bot.* ii. 280, f. 172. — Koch, *Dendr.* ii. pt. ii. 47. — Engelmann, *Trans. St. Louis Acad.* iii. 389. — Lauche, *Deutsche Dendr.* 294. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 141. — Houba, *Chênes Am. en Belgique*, 275, t. — Watson & Coulter, *Gray's Man.* ed. 6, 476. — Mayr, *Wald. Nordam.* 144, t. 1, 2. — Koehne, *Deutsche Dendr.* 127. — Dippel, *Handb. Laubholzk.* ii. 86.

Quercus Prinus discolor, Michaux f. *Hist. Arb. Am.* ii. 46, t. 6 (1812). — Brendel, *Trans. Ill. Agric. Soc.* iii. 617, t. 3. — Chapman, *Fl.* 424.

Quercus bicolor, β mollis, Nuttall, *Gen.* ii. 215 (1818); *Sylva*, i. 14. — Torrey, *Compend. Fl. N. States*, 359.

Quercus Prinus, β bicolor, Spach, *Hist. Vég.* xi. 158 (1842).

Quercus bicolor, β platanoides, A. de Candolle, *Prodr.* xvi. pt. ii. 21 (1864). — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 336.

A tree, usually sixty or seventy, or, exceptionally, a hundred feet in height,[1] with a trunk two or three or occasionally eight or nine feet in diameter and rather small limbs generally pendulous below and rising above into a narrow round-topped open head, and often furnished with short lateral pendulous branches. The bark on old trunks varies from one to two inches in thickness, and is deeply and irregularly divided by continuous or interrupted fissures into broad flat ridges covered with small appressed gray-brown scales sometimes slightly tinged with red; on young stems and small branches it is smooth and reddish or purplish brown, and separates freely into large papery persistent scales which in curling back or falling display the bright green inner bark. The branchlets are stout and marked with pale lenticels, and when they first appear are green, lustrous, and slightly scurfy-pubescent; during their first winter they are light orange-colored or reddish brown and glabrous or puberulous, and in their second or third year become darker and often purplish and clothed with a glaucous bloom. The buds vary in shape from broadly ovate and obtuse or subglobose to ovate and acute, and are about an eighth of an inch in length and covered by light chestnut-brown scales usually pilose above the middle with pale scattered fine hairs. The leaves are obovate or oblong-obovate, gradually narrowed and wedge-shaped at the entire base, acute or rounded at the apex, and coarsely sinuate-

[1] The largest specimen of *Quercus platanoides* of which a record has been preserved grew on the bottom-lands of the Genesee River on the Wadsworth estate, a mile from the village of Geneseo in the western part of New York. The Wadsworth Oak, as this tree was called, was destroyed several years ago by the washing away of the bank of the river. In 1851 the short trunk, which varied little in size between the ground and the branches, had an average circumference of twenty-seven feet with a minimum circumference of twenty-four. (See Buckley, *Am. Jour. Sci.* ser. 2, xiii. 397 [*Notice of some large Trees in Western New York*]. — Downing, *Landscape Gardening*, ed. H. W. Sargent, 122.)

dentate or sometimes pinnatifid with oblique rounded or acute entire lobes; when they unfold they are light bronze green and pilose on the upper surface and on the petioles, coated below with silvery white tomentum, and conspicuously glandular-toothed; and at maturity they are thick and firm, dark green and lustrous above, pale or often silvery white and downy with short soft pubescence below, five or six inches long and from two to four inches broad, with stout pale midribs rounded on the upper side and from six to eight pairs of conspicuous primary veins connected by reticulate cross veinlets and running obliquely to the points of the teeth or lobes, which are tipped with minute callous glandular points; they are borne on stout petioles grooved and flattened on the upper side and from one half to three quarters of an inch in length, and late in the autumn turn dull yellow-brown or occasionally orange-color and red before falling. The stipules are linear, acute, brown and scarious, coated with pale hairs, from one third to one half of an inch in length and caducous. The staminate flowers are produced in hairy aments three or four inches long; the calyx is light yellow-green, covered with pale hairs, and deeply divided into from five to nine lanceolate acute segments rather shorter than the stamens, which are composed of slender filaments and oblong apiculate glabrous yellow anthers. The pistillate flowers are produced in few-flowered spikes on elongated peduncles covered, like the involucral scales, with thick white or tawny tomentum; the stigmas are bright red. The fruit, which is usually in pairs, is borne on slender light or dark brown peduncles gradually thickened toward the apex, marked with pale lenticels, glabrous, puberulous or pubescent, and from an inch and a half to four inches in length; the nut is oval with a broad base, rounded or acute and covered with pale pubescence at the apex, light chestnut-brown, from three quarters of an inch to an inch and a quarter in length and from one half to three quarters of an inch in width; the cup, which incloses about a third of the nut, is cup-shaped, thick and woody, light brown and pubescent on the inside and hoary-tomentose on the outer surface, which is sometimes tuberculate or roughened toward the base by the thickened contorted tips of the ovate acute scales; higher on the cup these are free, thin, acute, chestnut-brown, and at the margin sometimes form a short fringe-like border, which, however, is frequently wanting; or sometimes all the scales of the cup are thin with free acute tips.

Quercus platanoides inhabits the borders of streams and swamps, growing in low moist fertile soil. It ranges from southern Maine to northern Vermont and southwestern Quebec, westward through Ontario[1] and the southern peninsula of Michigan to southeastern Iowa and western Missouri, and southward to the District of Columbia,[2] northern Kentucky and Arkansas,[3] and along the Appalachian Mountains to northern Georgia. Widely and generally distributed through all this region, it usually grows in small groves, rarely forming an important part of the forest, and is probably more abundant and of larger size in western New York and northern Ohio than in other parts of the country.

The wood of *Quercus platanoides* is heavy, hard, strong, and tough, although liable to check in seasoning; it contains broad conspicuous medullary rays and bands of from one to three rows of large open ducts marking the layers of annual growth, and is light brown, with thin hardly distinguishable sapwood. The specific gravity of the absolutely dry wood is 0.7662, a cubic foot weighing 47.75 pounds. It is used in construction, for the interior finish of houses, and in cabinet-making, in carriage and boat building, and in cooperage, for agricultural implements, railway ties, and fencing, and for fuel. Commercially it is not distinguished from the wood of *Quercus alba* and *Quercus macrocarpa*.

Quercus platanoides was first described by the French botanist Lamarck in 1783, from trees growing in the park of the château of Malesherbes.

[1] Brunet, *Cat. Vég. Lig. Can.* 48. — Bell, *Geolog. Rep. Can.* 1879–80, 55°. — Macoun, *Cat. Can. Pl.* 441.

The Blue Oak mentioned by Professor Macoun, which at one time furnished much of the oak timber exported from Ontario west of the Trent River, is now believed by him to be *Quercus macrocarpa*, the range of which eastward of Toronto he now doubts, although Mr. J. G. Jack has found this species on the St. Lawrence River south of Montreal.

[2] L. F. Ward, *Bull. U. S. Nat. Mus.* No. 22, 112 (*Fl. Washington*).

[3] Harvey, *Am. Jour. Forestry*, i. 454.

The specific name relates to the bark of the young trees, which resembles that of Platanus in its manner of separating into large thin scales. This juvenile flaky bark, peculiar to the species, and the small contorted and generally pendulous branches which often appear on the larger limbs and sometimes on the trunk, make it easy to recognize the Swamp White Oak at all seasons of the year.

EXPLANATION OF THE PLATES.

Plate CCCLXXX. Quercus platanoides.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate inflorescence, enlarged.
4. A pistillate flower, enlarged.

Plate CCCLXXXI. Quercus platanoides.

1. A fruiting branch, natural size.
2. A nut, natural size.
3. A cup, natural size.
4. Vertical section of a nut, natural size.
5. A seed, natural size.
6. A winter branchlet, natural size.

C. E. Faxon del. Lebrun sc.

QUERCUS PLATINOIDES, Sudw.

A. Riocreux direx.t Imp. J. Taneur, Paris.

C.E.Faxon del. Maniaud sc.

QUERCUS PLATINOIDES Sudw.

A.Riocreux direx.t Imp J Taneur, Paris.

QUERCUS MICHAUXII.

Basket Oak. Cow Oak.

LEAVES broadly obovate or oblong-obovate, wedge-shaped or rounded at the broad or narrow base, undulate-lobed with rounded or acute lobes, tomentose or pubescent and often silvery white on the lower surface.

Quercus Michauxii, Nuttall, *Gen.* ii. 215 (excl. syn.) (1818). — Elliott, *Sk.* ii. 609. — Sprengel, *Syst.* iii. 860. — Dietrich, *Syn.* v. 308. — Engelmann, *Trans. St. Louis Acad.* iii. 390. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 141. — Watson & Coulter, *Gray's Man.* ed. 6, 476. — Mayr, *Wald. Nordam.* 145, t. 1, 2. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 414 (*Man. Pl. W. Texas*).

Quercus Prinus, Walter, *Fl. Car.* 234 (not Linnæus) (1788). — Castiglioni, *Viag. negli Stati Uniti*, ii. 346. — Pursh, *Fl. Am. Sept.* ii. 633. — Elliott, *Sk.* ii. 608. — Gray, *Man.* 414.

Quercus Prinus (palustris), Michaux, *Hist. Chênes Am.* No. 5, t. 6 (not *Quercus palustris*, Muenchhausen) (1801); *Fl. Bor.-Am.* ii. 196. — Michaux f. *Hist. Arb. Am.* ii. 51, t. 7. — Loudon, *Arb. Brit.* iii. 1872, f. 1735, t. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 179.

Quercus Prinus, var. **discolor**, Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 33 (not Michaux f.) (1860).

Quercus Prinus, var. **Michauxii**, Chapman, *Fl.* 424 (1860).

Quercus bicolor, A. de Candolle, *Prodr.* xvi. pt. ii. 20 (in part) (1864).

Quercus bicolor, subspec. **Michauxii**, Engelmann, *Trans. St. Louis Acad.* iii. 390 (1877).

A tree, often a hundred feet in height, with a trunk sometimes free of branches for a distance of forty or fifty feet above the ground and from three to seven feet in diameter, and stout branches ascending at narrow angles and forming a round-topped rather compact head. The bark of the trunk is from half an inch to an inch in thickness, and separates into thin closely appressed silvery white or ashy gray scales more or less deeply tinged with red. The branchlets are stout and marked with scattered oblong pale lenticels, and when they first appear are dark green and covered with pale caducous hairs; during their first winter they are bright red-brown or light orange-brown, and ultimately become ashy gray. The buds are broadly ovate or oval, acute, a quarter of an inch long, and covered with numerous thin closely and regularly imbricated dark red puberulous scales with pale scarious margins, those of the inner ranks being coated on the outer surface with loose pale tomentum. The leaves are convolute in the bud, broadly obovate or oblong-obovate, wedge-shaped or rounded at the broad or narrow entire base, acute, or acuminate with short broad points at the apex, and regularly crenately lobed with oblique rounded entire lobes sometimes furnished with glandular tips; or rarely they are entire, with undulate margins; when they unfold they are bright yellow-green, lustrous and pubescent with scattered pale hairs above and coated below with thick silvery white or pale ferrugineous tomentum, and at maturity they are thick and firm, or sometimes membranaceous, especially on young and vigorous branches, dark green and lustrous on the upper surface, which is glabrous or occasionally roughened with scattered stellate hairs, more or less densely pubescent on the pale green or silvery white lower surface, from six to eight inches long and from three to five inches wide, with stout midribs impressed on the upper side, and slender primary veins running obliquely to the points of the lobes and connected by conspicuous reticulate cross veinlets; they are borne on stout pubescent flattened and grooved petioles, varying from half an inch to an inch and a half in length, and late in the autumn turn a dark rich crimson before falling. The stipules are linear-obovate or linear-lanceolate, brown and scarious, covered with thick pale hairs, and caducous. The flowers appear from the end of March to the middle of May, when the leaves are nearly half grown, the staminate in slender hairy aments three or four inches in

length, the pistillate in few-flowered spikes on short peduncles coated, like the involucral scales, with dense pale rufous tomentum. The calyx of the staminate flower is light yellow-green, pilose with long pale hairs, and divided into from four to seven acute lobes; the stamens are composed of slender filaments and broad oblong slightly emarginate yellow glabrous anthers. The stigmas are dark red. The fruit is solitary or in pairs, and is sessile or subsessile or borne on a short stout puberulous peduncle marked with pale lenticels and rarely half an inch in length; the nut is oval or ovate, with a broad base and an acute rounded or occasionally truncate apex, which is clothed with a narrow ring of rusty pubescence; it is sometimes pilose nearly to the middle, and is bright brown, rather lustrous, from an inch to an inch and a half in length and from three quarters of an inch to nearly an inch and a quarter in width, and contains a sweet seed; the cup, which incloses about a third of the nut, is thick, cup-shaped, and often broad and flat on the bottom, reddish brown and pubescent within, and hoary-tomentose on the outer surface, which is covered with regularly imbricated large ovate acute free scales rounded and much thickened on the back, with thin reddish margins and short tips which sometimes form a rigid fringe-like border to the rim of the cup.

Quercus Michauxii inhabits the borders of streams, low swamps, and bottom-lands often covered with water, and is distributed from the neighborhood of Wilmington, Delaware, southward through the coast and middle districts to northern Florida, through the Gulf states to the valley of the Trinity River in Texas, and through Arkansas and southeastern Missouri to central Tennessee and Kentucky and the valley of the lower Wabash River in Illinois and Indiana.[1]

Quercus Michauxii is one of the most important timber-trees of eastern North America, and the largest and most valuable White Oak of the southeastern states. The wood is heavy, hard, very strong and tough, close-grained, very durable in contact with the soil, and easily split. It is light brown, with thin darker colored sapwood, and contains broad conspicuous medullary rays and bands of large open ducts marking the layers of annual growth. The specific gravity of the absolutely dry wood is 0.8039, a cubic foot weighing 50.10 pounds. It is largely used in all kinds of construction, for agricultural implements and wheels, in cooperage, for fences and for fuel, and in the manufacture of strong baskets, for which purpose, as it can be so easily split into thin plates, it is excelled by the wood of no other American tree. The seeds are sweeter than those of the other Oaks of eastern North America, and are eaten by domestic animals, and by children and negroes.

Quercus Michauxii is the most beautiful of the Chestnut Oaks and one of the most striking and imposing of the trees of eastern North America, always conspicuous from the silvery white bark of the tall massive trunk and the broad crown of large and finely colored foliage. First described in 1731 in *The Natural History of Carolina*[2] by Mark Catesby, who confounded it with what has usually been considered the Chestnut Oak of Plukenet, the *Quercus Prinus* of Linnæus, it was long considered a variety of that tree.

[1] Ridgway, *Proc. U. S. Nat. Mus.* v. 81; xvii. 414.

[2] *Quercus castaneæ foliis, procera arbor virginiana*, i. 18, t. 18 (not Plukenet).

Michaux (*Hist. Chênes Am.*) considered that Plukenet's *Quercus Mariana, muricatis Castaneæ foliis subtus villosis* (*Amalth. Bot.* 180) referred to this species, but the description is too vague to make this certain.

EXPLANATION OF THE PLATES.

Plate CCCLXXXII. Quercus Michauxii.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate inflorescence, enlarged.
4. Base of a leaf, natural size.
5. Base of a leaf, natural size.

Plate CCCLXXXIII. Quercus Michauxii.

1. A fruiting branch, natural size.
2. A nut, natural size.
3. A winter branchlet, natural size.

C.E. Faxon del. *Lövendal sc.*

QUERCUS MICHAUXII, Nutt.

A. Riocreux direx.t *Imp. J. Taneur, Paris*

C. E. Faxon del. *Lebrun sc.*

QUERCUS MICHAUXII, Nutt.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

QUERCUS BREVILOBA.

White Oak.

LEAVES obovate or oblong, undulate, lobed with short broad lobes or entire, pale, often silvery white and pubescent on the lower surface.

Quercus breviloba, Sargent, *Garden and Forest*, viii. 93 (1895).

Quercus obtusifolia, var. ? **breviloba**, Torrey, *Bot. Mex. Bound. Surv.* 206 (1859).

Quercus Durandii, Buckley, *Proc. Phil. Acad.* 1860, 445. — Young, *Bot. Texas*, 507. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 145. — Mayr, *Wald. Nordam.* 145. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 415 (*Man. Pl. W. Texas*).

Quercus annulata, Buckley, *Proc. Phil. Acad.* 1860, 445.

Quercus San-Sabeana, Young, *Bot. Texas*, 507 (1873).

Quercus undulata, Engelmann, *Trans. St. Louis Acad.* iii. 392 (in part) (not Torrey) (1877).

A tree, sometimes eighty or ninety feet in height when growing east of the Mississippi River, with a tall straight trunk frequently from two to three feet in diameter; in Texas much smaller, rarely more than twenty or thirty feet in height, with a short trunk usually dividing near the ground into two or three spreading limbs and seldom more than twelve or fifteen inches in diameter; and frequently, especially toward the western limits of its range, small and shrubby, often forming extensive thickets. The bark of the trunk is from one quarter to one half of an inch in thickness and separates into long narrow plate-like scales about a sixteenth of an inch thick; it is silvery white and tinged with reddish brown on the surface, and thus trunks seen from a little distance produce the effect of being reddish in general color. The branchlets are slender and marked with pale lenticels, and when they first appear are coated with hoary tomentum; during the following winter they are gray, faintly tinged with red, or ashy gray and grow darker during the second and third years. The winter-buds are broadly ovate or oval, acuminate, and from a sixteenth to an eighth of an inch long, and are covered with light chestnut-brown closely and regularly imbricated puberulous scales pale and scarious on the margins. The leaves are convolute in the bud, obovate or oblong, usually gradually narrowed and acute or rarely broader and equally or unequally rounded at the base, and broad and rounded and often emarginate or narrowed and rounded or rarely acute at the apex; they are undulate-lobed with from four to seven broad lobes, or are obscurely three-lobed at the broad apex and entire below, or are undulate or coarsely and remotely dentate with acute spinescent teeth, or are often entire, and on vigorous shoots are frequently oblong-obovate and more or less deeply divided by wide sinuses rounded at the bottom into broad lobes which increase in size from the base to the apex of the leaf; when they unfold they are thin, covered with scattered pale stellate hairs on the upper surface and coated with thick pale pubescence on the lower, and at maturity they are thin on trees grown in the eastern Gulf states and thicker and often subcoriaceous on those grown in the drier climate of Texas, light blue or yellow-green and usually lustrous above, and pubescent and paler and often silvery white below; they are usually from an inch and a half to three inches long and from three quarters of an inch to an inch and a half wide, although on trees east of the Mississippi River and on young vigorous branches they are sometimes from four to six inches in length and two and a half inches broad; they are obscurely reticulate-venulose and furnished with narrow pale yellow midribs raised and rounded on the upper side, and slender veins running to the slightly thickened and revolute margins of the leaf or forked within them; borne on stout grooved petioles rarely more than a quarter of an inch in length, they turn pale yellow and fall in the autumn, or in western Texas sometimes irregularly during the winter or in the early spring. The flowers appear with the first unfolding of the leaves from March to the end of April, the staminate borne on hairy

aments from an inch and a half to two inches long, the pistillate on short peduncles coated with thick hoary tomentum. The calyx of the staminate flower is pale yellow and divided into nearly triangular segments much shorter than the from five to seven stamens, which are composed of short slender filaments and broad oblong emarginate glabrous yellow anthers. The scales of the pistillate flowers are coated with pale tomentum, and their stigmas are dull red. The acorns are sessile or subsessile and usually solitary; the nut is ovate, obovate or oval, acute or rounded and sometimes depressed at the broad apex, which is usually clothed with a narrow ring of pale pubescence, from half an inch to an inch in length and from three eighths to three fifths of an inch in width; the cup, which incloses only the base of the nut, is saucer-shaped, thin and shallow, bright reddish brown and pubescent on the inner surface, and covered on the outer with regularly and closely imbricated ovate bright red-brown scales clothed with hoary pubescence except at their acute or rounded appressed tips.

Quercus breviloba inhabits the rich limestone prairie region of central Alabama and Mississippi,[1] finding its most eastern home in the valley of the Mulberry Fork of the Tombigbee River in Blount County, Alabama.[2] It reappears on the banks of the Red River at Shreveport,[3] and in Texas ranges from the neighborhood of the city of Dallas westward to the central part of the state and southward near streams flowing into the Gulf of Mexico to the mountains of Nuevo Leon in the vicinity of Monterey.[4] East of the Mississippi River, where it attains its largest size, it grows on dry prairies with the Post Oak, the Black Jack, the White Oak, and the Nutmeg Hickory, or in low ground subject to overflow, where it is scattered through the forests of the Swamp Chestnut Oak, the Willow Oak, and the Texas Oak; in Texas, where it grows on the dry limestone banks of streams and rocky bluffs,[5] it is usually associated with the Post Oak, the Texas Oak, the Cedar Elm, and the western Juniper.

The wood of *Quercus breviloba* grown in Texas is very heavy, hard, and strong, although brittle and inclined to check in drying. It is brown, with thick lighter colored sapwood, and contains numerous conspicuous medullary rays and bands of large open ducts marking the layers of annual growth. The specific gravity of the absolute dry wood is 0.9507, a cubic foot weighing 59.29 pounds. When grown in Alabama and Mississippi it is said to equal the best white oak and to be used for the same purposes as that wood; it is especially valued for the pins in cotton-gins and in the manufacture of spools, baskets, and wagon-hubs.

Quercus breviloba was discovered in western Texas in 1850 by Dr. J. M. Bigelow,[6] one of the botanists of the Mexican Boundary Survey; in September, 1859, it was found near Clinton, in Wilcox County, Alabama, by Mr. S. B. Buckley,[7] who saw it in October of the same year at Shreveport, Louisiana, and, finding it afterward in Texas, first distinguished the specific characters of this useful and beautiful tree.

[1] In Mississippi *Quercus breviloba* has been seen by Dr. Mohr only near Columbus, and in the neighborhood of Mhoons Valley, in the centre of the state.

[2] Mohr, *Garden and Forest*, vi. 372.

[3] Buckley, *Proc. Phil. Acad.* 1881, 121.

[4] *Quercus breviloba* was discovered in Nuevo Leon on April 6, 1887, by C. S. Sargent.

[5] Reverchon, *Garden and Forest*, vi. 524.

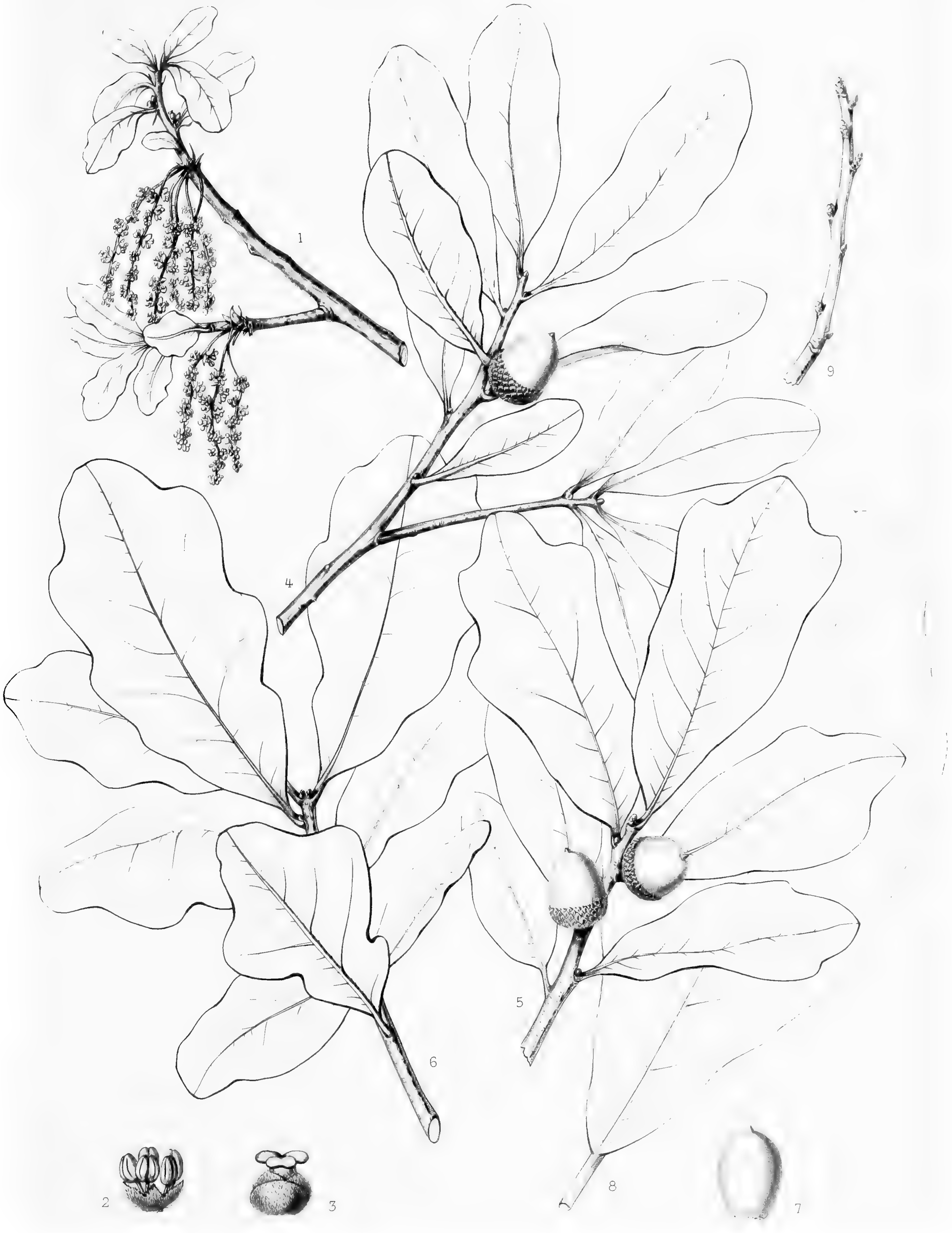
[6] See i. 88.

[7] See iii. 3.

EXPLANATION OF THE PLATE.

PLATE CCCLXXXIV. QUERCUS BREVILOBA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A fruiting branch, natural size.
6. A sterile branch, natural size.
7. A nut, natural size.
8. A leaf, natural size.
9. A winter branchlet, natural size.



C. E. Faxon del.

Himely sc.

QUERCUS BREVILOBA, Sarg.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

QUERCUS UNDULATA.

Scrub Oak. Shin Oak.

LEAVES oblong, sinuate-dentate, entire, pinnatifid, lobed or spinescent. blue-green, pubescent.

Quercus undulata, Torrey, *Ann. Lyc. N. Y.* ii. 248, t. 4 (excl. fruit) (1828); *Marcy's Rep.* 284; *Bot. Mex. Bound. Surv.* 206. — Nuttall, *Sylva*, i. 8, t. 3 (excl. fruit). — Watson, *Am. Nat.* vii. 302 (*Plants of Northern Arizona*) (in part). — Engelmann, *Trans. St. Louis Acad.* ii. 384 (excl. *α Gambelii*, *β Gunnisoni*), 392 (in part). — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 199. — Greene, *West Am. Oaks*, 27 (in part), t. 13, f. 4; pt. ii. 65, t. 30. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 415 (*Man. Pl. W. Texas*) (excl. var. *Gunnisoni*). — Sargent, *Garden and Forest*, viii. 92.

Quercus Fendleri, Liebmann, *Oversigt Dansk. Vidensk. Selsk. Forhandl.* 1854, 170. — Örsted, *Liebmann Chênes Am. Trop.* 22. — Greene, *West Am. Oaks*, pt. ii. 67, t. 31.

Quercus grisea, Liebmann, *Oversigt Dansk. Vidensk. Selsk. Forhandl.* 1854, 171. — Örsted, *Liebmann Chênes Am. Trop.* 22. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 415 (*Man. Pl. W. Texas*).

Quercus pungens, Liebmann, *Oversigt Dansk. Vidensk. Selsk. Forhandl.* 1854, 171. — Örsted, *Liebmann Chênes Am. Trop.* 22, (1869). — Greene, *Pittonia*, ii. 112.

Quercus oblongifolia, Torrey, *Bot. Mex. Bound. Surv.* 206 (not *Sitgreaves' Rep.*) (1859).

Quercus undulata, β obtusifolia, A. de Candolle, *Prodr.* xvi. pt. ii. 23 (1864). — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 199.

Quercus undulata, γ pedunculata, A. de Candolle, *Prodr.* xvi. pt. ii. 23 (1864).

Quercus Emoryi, Porter & Coulter, *Syn. Fl. Colorado*, 127 (not Torrey) (1874).

Quercus undulata, γ Jamesii, Engelmann, *Trans. St. Louis Acad.* iii. 382 (1876).

Quercus undulata, δ Wrightii, Engelmann, *Trans. St. Louis Acad.* iii. 382 (1876).

Quercus undulata, var. **pungens**, Engelmann, *Trans. St. Louis Acad.* iii. 392 (1877); *Rothrock Wheeler's Rep.* vi. 250. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 199.

Quercus undulata, var. **grisea**, Engelmann, *Trans. St. Louis Acad.* iii. 393 (1877). — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 200.

Quercus undulata, var. **oblongata**, Engelmann, *Rothrock Wheeler's Rep.* vi. 250 (1878).

Quercus turbinella, Greene, *West Am. Oaks*, 37; pt. ii. 59, t. 27 (in part) (1889).

This little Oak, which is widely distributed from the cliffs above the cañon of the Arkansas River in the eastern foothills of the Rocky Mountains in Colorado to western Texas, and through New Mexico and Arizona to southern Utah and Nevada and to northern Mexico, is extremely variable in size and habit, in the shape of its leaves, and in the size of its fruit. Usually a shrub, forming small thickets by vigorous stolons, and with stout more or less contorted stems from two to eight feet tall, it rises only in the cañons of some of the mountain ranges of southeastern Arizona to the height of twenty-five or thirty feet, with a straight trunk from six to eight inches in diameter and scaly pale bark slightly tinged with reddish brown.[1] The slender branches, which are marked with pale lenticels, are coated, when they first appear, with dense hoary tomentum, and during their first winter are light reddish brown or ashy gray and pubescent or tomentose, ultimately becoming glabrous and dark brown or gray. The buds are oval and about an eighth of an inch long, and are covered by a few thin light red-brown scales often ciliate on the margins with loose pale hairs. The leaves are convolute in the bud, oblong, sinuate-dentate, entire, pinnatifid, lobed or spinescent, broad and rounded or cordate or rarely abruptly wedge-shaped at the base, and usually acute or occasionally rounded at the apex; when they unfold they are coated with hoary tomentum, and at maturity they are thick and firm, light blue-green, more

[1] Toumey, *Garden and Forest*, viii. 13.

Dr. Havard (*Proc. U. S. Nat. Mus.* viii. 505) speaks of *Quercus grisea* as a small tree and the most abundant and characteristic Oak of western Texas, but as he makes no mention of *Quercus Gambelii*, a common tree in this region, it is possible that he may have confounded the two species. His collection preserved in the National Museum contains specimens almost identical with the type of *Quercus grisea*, which is now united with *Quercus undulata*.

or less thickly covered with stellate hairs on the upper surface, and clothed on the lower with pale or yellow pubescence, and vary from an inch to three inches in length and from one to three quarters of an inch in width, with pale slender midribs, few conspicuous primary veins running to the points of the teeth or arcuate and united within the more or less thickened and revolute margins, reticulate veinlets, conspicuous both above and below, and stout pubescent or tomentose petioles rarely more than a quarter of an inch, although sometimes, especially on vigorous shoots, nearly an inch in length. In the north and at high elevations the leaves fall in the autumn, but in southern New Mexico and Arizona they sometimes remain on the branches until the appearance of the new growth of the following spring, or fall gradually and irregularly during the winter. The flowers appear with the first unfolding of the leaves, the staminate borne in short tomentose aments from one to two inches in length, the pistillate sessile or on tomentose peduncles. The hairy calyx of the staminate flowers is divided into acute segments shorter than the stamens, which are composed of slender filaments and broad oblong emarginate light yellow glabrous anthers. The involucral scales of the pistillate flower are coated with pale tomentum, and the stigmas are red. The acorns, which are solitary or in pairs, are sessile or raised on stout hoary peduncles varying from a quarter of an inch to nearly two inches in length; the nut is oval, rounded and rather obtuse or sometimes acute at the apex, and from three quarters of an inch to an inch long, with sweet seeds; the cup is cup-shaped, thick, light reddish brown and pubescent on the inner surface, hoary-tomentose on the outer, and covered by ovate acute scales usually thickened and tumid on the back toward the base of the cup, and above its middle ending in thin bright red free ciliate tips; or sometimes all the scales are thin with free tips.

The seeds, raw or baked, are eaten by Indians and Mexicans, and furnish hogs with excellent food.

In Colorado *Quercus undulata* grows on dry rocky mountain ridges mixed with clumps of shrubby forms of *Quercus Gambelii*, from which it can be readily distinguished by the blue color of the leaves; it is found in similar situations on the mountains of western Texas, and in New Mexico and southern Arizona, where it is comparatively rare; in central Arizona, south of the Colorado plateau, it covers low mountain ranges with vast thickets from six to eight feet tall, furnishing valuable and nutritious fodder to cattle and sheep, which eagerly browse on the leaves and young branches. In southern Utah and Nevada it is less common and is local in distribution.[1]

Quercus undulata was discovered on the head-waters of the Canadian River in 1820 by Dr. Edwin James,[2] the naturalist of the expedition sent under the command of Major Long by the government of the United States to explore the Rocky Mountains.

[1] On the type specimen (Plate ccclxxxv. f. 4) of this species preserved in the herbarium of Columbia College in New York city, the leaves are oblong, narrowed and rounded at the base, acute and rounded at the apex, coarsely sinuate-dentate, pubescent with scattered stellate hairs on the upper surface, covered with pale tomentum on the lower surface, and from an inch and a half to two inches and a half in length; this is the variety *Jamesii* of Engelmann, and plants of this form produce leaves which vary from entire to deeply pinnatifid and from oblong to linear-oblong, those on vigorous shoots being deeply lobed with rounded or acute oblique lobes and sometimes three to four inches in length, with petioles sometimes nearly an inch long. An unattached nut, preserved with the type specimen of *Quercus undulata* which appears in the original figure and in Nuttall's copy of it, probably belonged to some other plant, as was suggested by Torrey himself.

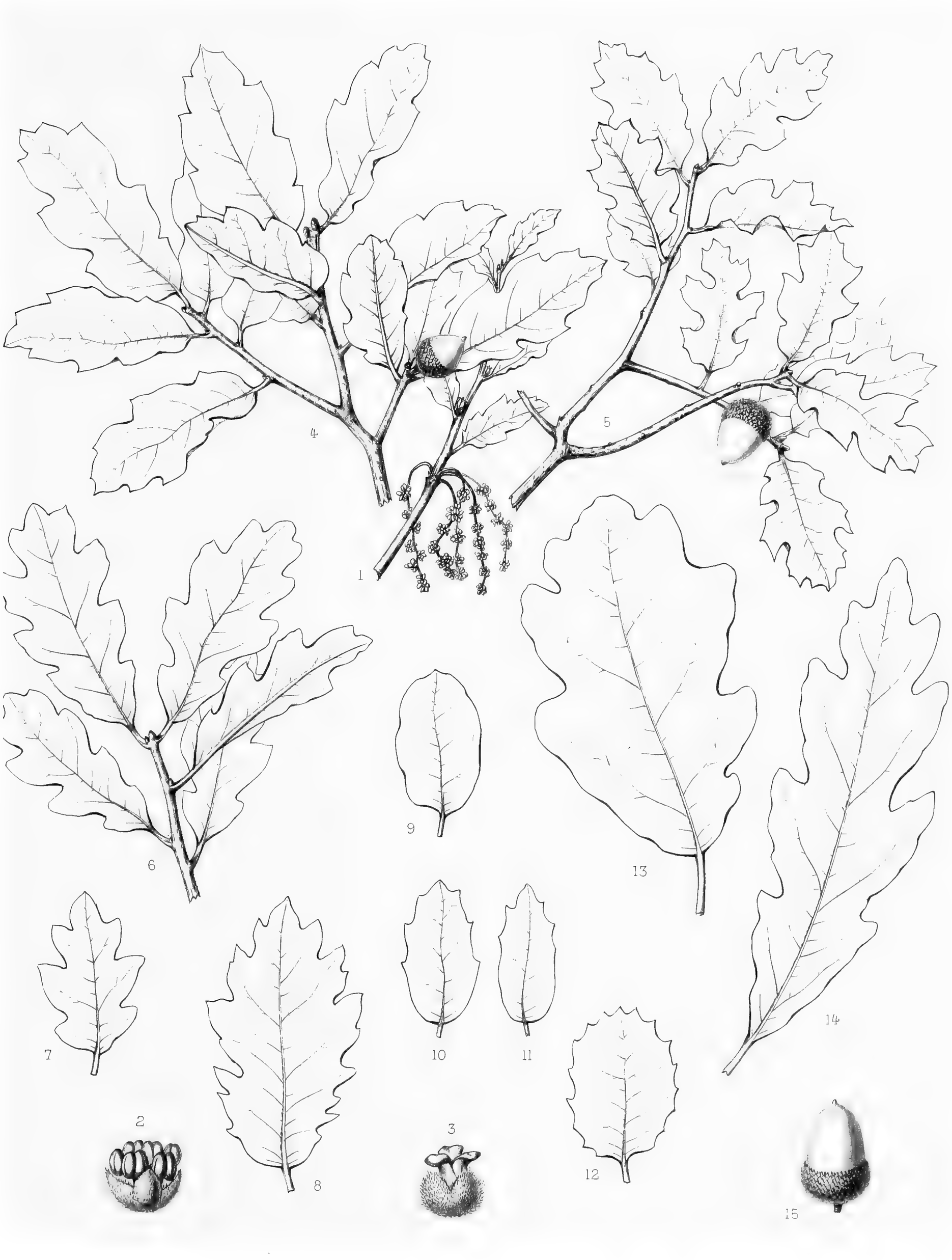
A form with nearly oval pubescent leaves rounded or pointed at the apex, rather deeply cordate at the base, an inch long and three quarters of an inch broad, is the type of Liebmann's *Quercus grisea;* and a form with leaves of the same size and shape, but with spinescent teeth, is his *Quercus pungens* (the varieties *pungens* and *Wrightii* of Engelmann), a not unusual plant from western Texas to southern Utah and Nevada. In southern Arizona this spinescent-leaved form sometimes bears larger and more undulate leaves (Plate ccclxxxv. f. 5), and in central and southern Arizona small ovate acute sometimes entire or slightly spinescent broad or narrow acute and mostly cordate leaves covered on the lower surface with pale or yellow pubescence and from half an inch to an inch in length. This last, which produces small acorns with shallow cups usually covered by thin scales, is the common Oak of the mountains of central Arizona.

[2] See ii. 96.

EXPLANATION OF THE PLATE.

PLATE CCCLXXXV. QUERCUS UNDULATA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A fruiting branch, natural size.
6. A sterile branch, natural size.
7. A leaf, natural size.
8. A leaf, natural size.
9. A leaf, natural size.
10. A leaf, natural size.
11. A leaf, natural size.
12. A leaf, natural size.
13. A leaf, natural size.
14. A leaf, natural size.
15. A fruit, natural size.



C.E. Faxon del. *Himely sc.*

QUERCUS UNDULATA, Torr.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

QUERCUS DOUGLASII.

Blue Oak. Mountain White Oak.

LEAVES oblong, lobed, spinescent or entire, blue-green and pubescent.

Quercus Douglasii, Hooker & Arnott, *Bot. Voy. Beechey*, 391 (1841). — Hooker, *Icon.* iv. t. 382, 383. — Bentham, *Pl. Hartweg.* 337; *Bot. Voy. Sulphur*, 55. — Nuttall, *Sylva*, i. 10, t. 4. — Dietrich, *Syn.* v. 311. — Torrey, *Pacific R. R. Rep.* v. 365; *Bot. Wilkes Explor. Exped.* 462. — A. de Candolle, *Prodr.* xvi. pt. ii. 23. — Bolander, *Proc. Cal. Acad.* iii. 230. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 66; *Liebmann Chênes Am. Trop.* t. 41, f. 3, 4. — Engelmann, *Trans. St. Louis Acad.* iii. 392; *Brewer & Watson Bot. Cal.* ii. 95. — Hall, *Bot. Gazette*, ii. 93. — Kellogg, *Forest Trees of California*, 70. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 143. — Greene, *West Am. Oaks*, 17, t. 9, f. 1, 2; t. 12, f. 4, 5; *Man. Bot. Bay Region*, 302. — Mayr, *Wald. Nordam.* 264, t. 2, 5. — Dippel, *Handb. Laubholzk.* ii. 76, f. 30. — Koehne, *Deutsche Dendr.* 128. — Merriam, *North American Fauna*, No. 7, 333 (*Death Valley Exped.* ii.). — Coville, *Contrib. U. S. Nat. Herb.* iv. 196 (*Bot. Death Valley Exped.*).

Quercus Ransomi, Kellogg, *Proc. Cal. Acad.* i. 25 (1855). — Mary K. Curran, *Bull. Cal. Acad.* i. 146. — Brandegee, *Zoë*, i. 156.

? Quercus oblongifolia, R. Brown Campst. *Ann. and Mag. Nat. Hist.* ser 2, vii. 252 (not Torrey) (1871).

Quercus oblongifolia, var. **brevilobata**, Torrey, *Bot. Wilkes Explor. Exped.* 460 (1874).

A tree, rarely eighty or ninety but usually fifty or sixty feet in height, with a trunk three or four feet in diameter and short stout branches which, spreading nearly at right angles, form a dense round-topped symmetrical head; or frequently not more than twenty or thirty feet high, and sometimes, especially toward the southern limits of its range, shrubby in habit. The bark of the trunk is from half an inch to an inch in thickness and is generally pale, although the small scales into which the surface divides are tinged with brown or light red.[1] The branchlets are stout and marked with pale lenticels, and, being extremely brittle at the joints, can be easily broken from the branch; when they first appear they are coated with short dense hoary tomentum, which continues to cover them more or less thickly during the summer, and in their first winter they are dark gray or reddish brown and tomentose, pubescent, or puberulous, and in their second or third year grow ashy gray or dark brown. The winter-buds are ovate, obtuse, from an eighth to nearly a quarter of an inch in length, and are covered with light and rather bright red pubescent scales. The leaves[2] are convolute in the bud, and are oblong, gradually narrowed and wedge-shaped or broad and rounded or subcordate at

[1] Miss Alice Eastwood, the curator of the botanical department of the California Academy of Sciences, whose unrivaled collection of California Oaks made in the central and southern parts of the state during the autumn of 1894 has been of great assistance to me, calls my attention to the fact that *Quercus Douglasii* has very light gray bark on trees growing on exposed hillsides and open plains, and much darker bark on trees in sheltered valleys and arroyos.

[2] On the foothills and in the valleys of northern and central California the leaves of *Quercus Douglasii* are perhaps larger and more commonly lobed than in the southern part of the state, where they are usually small and often spinescent and entire, but trees with large lobed leaves sometimes bear on the same branch smaller and nearly entire leaves also, and individuals with lobed leaves are common at the south. A specimen collected in Round Valley, Mendocino County, in June, 1893, by Mr. G. W. Blankinship, with thin broadly obovate-oblong leaves entire or slightly notched-toothed at the wide rounded apex, apparently belongs to this species, and to it also must probably be referred the *Quercus oblongifolia* of R. Brown Campst. (not of Torrey), described as a bush three feet high from the mountains of southern Oregon, which, in the specimen without fruit preserved in the herbarium of the Royal Botanic Garden at Edinburgh, has ovate or oblong-elliptical and nearly entire leaves hardly distinguishable in size and shape from those of some forms of *Quercus Douglasii* from southern California.

No American Oak, with the exception perhaps of *Quercus dumosa*, is more variable than *Quercus Douglasii* in the size, shape, and dentation of its leaves. They are readily recognized in the field by their blue color, as this is the only blue-leaved Oak of northern and central California; but in the herbarium it is not always easy to distinguish some of the southern forms of this species from the green-leaved *Quercus dumosa*, and Miss Eastwood suggests that natural hybridizing between these trees would account for the apparent running together of the two species, which in most of their forms are, however, very unlike.

the base, acute or rounded at the apex, and divided by deep or shallow wide or narrow sinuses acute or rounded at the bottom into four or five broad or narrow acute or rounded and often mucronate lobes, and are from two to five inches long and from an inch to an inch and three quarters broad; or they are oval, oblong or obovate, rounded or acute at the apex, equally or unequally wedge-shaped or rounded at the base, regularly or irregularly sinuate-toothed with rounded acute and rigid spinescent teeth or denticulate toward the apex and entire below, from one to two inches long and from a quarter of an inch to an inch wide; when they unfold the leaves are covered with soft pale pubescence and are tomentose on the petioles, and at maturity they are thin, although firm and rather rigid, pale blue and pubescent with scattered stellate hairs on the upper surface, and on the lower pale blue or often yellow-green and covered with short soft pubescence; they are more or less conspicuously reticulate-venulose, furnished with pale prominent hirsute or puberulous midribs raised and rounded on the upper side, with primary veins which, when the leaves are lobed, are conspicuous and run to the points of the lobes, and prominent lateral veins arcuate and united near the slightly thickened and revolute margins; or when the leaves are entire or dentate the veins are less prominent and are usually united before reaching the margin; the leaves are borne on stout grooved petioles varying from a quarter to a half of an inch in length and fall late in the autumn. The stipules are lanceolate-obovate or linear-lanceolate, thin and scarious and coated with pale hairs. The flowers appear from February to April, the staminate, which are subtended by linear-lanceolate bracts, are borne in hairy aments, and the pistillate in short few-flowered spikes coated, like the involucral scales, with hoary tomentum. The calyx of the staminate flower is yellow-green, covered on the outer surface with pale hairs and deeply divided into broad acute laciniately cut segments shorter than the stamens, which are composed of slender filaments and ovate-oblong emarginate glabrous yellow anthers. The acorns are sessile or short-stalked, solitary or in pairs, and are sometimes produced in such abundance that they make the trees, seen from a little distance, appear green; the nut is broadly oval, often ventricose with a narrow base, gradually narrowed and acute at the apex, from three quarters of an inch to an inch long and from half an inch to nearly an inch broad, or it is often ovate acute and from an inch to an inch and a half in length and not more than a quarter of an inch in breadth; it is bright green and lustrous, soon turning dark chestnut-brown in drying, and is furnished at the apex with a small ring of hoary pubescence; the cup, which embraces only the base of the nut, is cup-shaped, thin and shallow, light green and pubescent on the inner surface and covered on the outer with small acute and usually thin, although sometimes, especially in the south, thicker tumid scales coated with pale pubescence or tomentum and ending in thin reddish brown points.

Quercus Douglasii inhabits low hills, dry mountain-slopes and valleys, and is distributed from Mendocino County, California, and the upper valley of the Sacramento River, southward along the western slopes of the Sierra Nevada, which it ascends to elevations of four thousand feet above the level of the sea, and through the valleys of the coast ranges to the Tehachapi Pass, which it crosses, with occasional stunted individuals, to the borders of the Mohave Desert, and probably grows to its largest size and is most abundant in the Jolon and other valleys between the coast mountains and the interior ridges of the Coast Range south of the Bay of San Francisco.

The wood of *Quercus Douglasii* is very hard, heavy and strong, although brittle and inclined to check badly in drying. It is dark brown, becoming nearly black with exposure, with thick light brown sapwood,[1] and contains numerous medullary rays, scattered groups of small ducts, and rows of larger ducts marking the layers of annual growth. The specific gravity of the absolutely dry wood is 0.8928, a cubic foot weighing 55.64 pounds. Of little use for construction and in the arts, it makes excellent fuel.

[1] The sapwood of *Quercus Douglasii* is thicker than that of most American White Oaks. The log specimen in the Jesup Collection of North American Woods in the American Museum of Natural History, New York, which is twenty-three inches in diameter, shows two hundred and thirty-two layers of annual growth, of which eighty-eight, measuring three and three fifths inches in thickness, are sapwood.

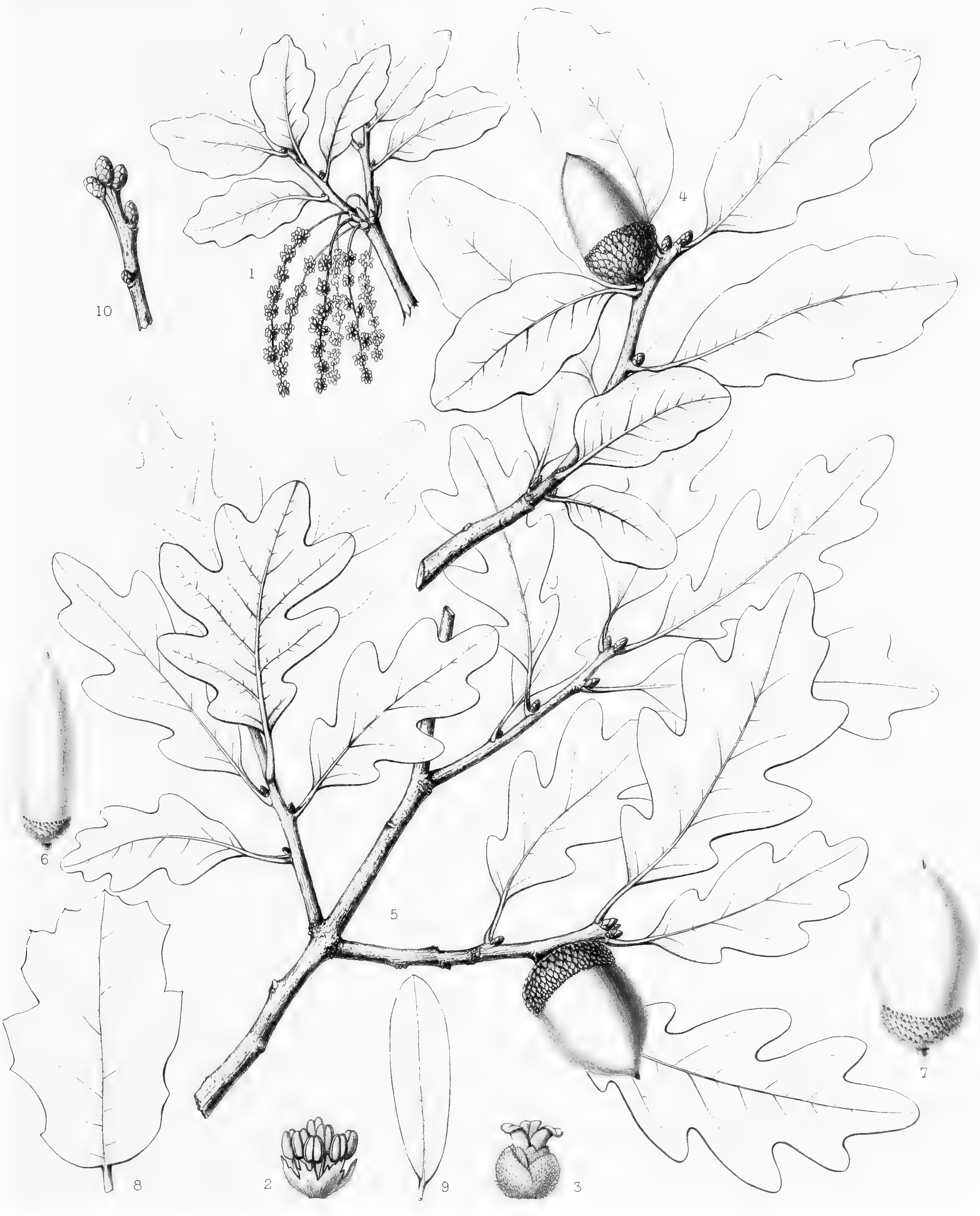
With its pale bark, its dense round head of light blue foliage, and its large acorns, *Quercus Douglasii*, which was discovered by the indefatigable and successful collector [1] whose name it helps to commemorate, is one of the most beautiful of the California Oaks. Never forming forests, it is scattered in innumerable numbers over foothills and high valleys, and, either alone on the hills or with the statelier *Quercus lobata* in the valleys, gives them their characteristic park-like appearance.

[1] See ii. 94.

EXPLANATION OF THE PLATE.

PLATE CCCLXXXVI. QUERCUS DOUGLASII.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A fruiting branch, natural size.
6. A fruit, natural size.
7. A fruit, natural size.
8. A leaf, natural size.
9. A leaf, natural size.
10. A winter branchlet, natural size.



C.E.Faxon del.

Lebrun sc.

QUERCUS DOUGLASII, Hook.& Arn.

A.Riocreux direx.t

Imp. J.Taneur, Paris.

QUERCUS ENGELMANNI.

Evergreen White Oak.

LEAVES oblong or obovate, usually obtuse and rounded at the apex, entire or remotely dentate, dark blue-green.

Quercus Engelmanni, Greene, *West Am. Oaks*, 32, t. 15, f. 2, 3; t. 17 (1889). — Sargent, *Garden and Forest*, ii. 471. — S. B. Parish, *Zoë*, iv. 345.

Quercus oblongifolia, Torrey, *Ives' Rep.* pt. iv. 28 (not *Sitgreaves' Rep.*) (1861). — Engelmann, *Trans. St. Louis Acad.* iii. 393 (in part); *Brewer & Watson Bot. Cal.* ii. 96 (in part). — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 143 (in part).

A tree, fifty or sixty feet in height, with a trunk two or three feet in diameter, and stout branches spreading nearly at right angles and forming a broad rather irregular handsome head. The bark of the trunk is from an inch and a half to two inches in thickness, light gray tinged with brown and deeply divided by narrow fissures into broad flat ridges separating on the surface into small thin appressed scales. The branchlets are stout, rigid, and marked with pale lenticels, and at first are coated with hoary tomentum which soon begins to disappear; during their first winter they are light or dark brown tinged with red and clothed with short fine pubescence, and become glabrous and light brown or gray during their second or third years. The winter-buds are oval or ovate, about an eighth of an inch long, and covered by thin light red puberulous scales. The leaves are revolute in the bud, oblong or obovate, gradually or abruptly wedge-shaped or rounded or cordate at the base, and usually obtuse and rounded but sometimes acute at the apex; they are entire and often undulate, or sinuate-toothed with occasional minute rigid teeth; or near the ends of sterile branches they are frequently coarsely and crenately serrate with incurved callous-tipped teeth or rarely lobed with acute oblique or broad rounded lobes; when they unfold they are light red and coated, like the petioles, with thick pale rufous tomentum, which is soon replaced by scurfy pubescence; and at maturity they are thick and firm in texture, dark blue-green and glabrous or covered with scattered stellate hairs on the upper surface, and pale and usually yellow-green on the lower surface, which is clothed with light brown pubescence or is puberulous or frequently glabrous; they vary from one to three inches in length and from half an inch to two inches in width, but are usually about two inches long and an inch wide, with stout midribs raised and rounded on the upper side, obscure primary veins arcuate and united near the margins, and slender reticulate veinlets; and, borne on slender pubescent petioles varying from one quarter to one half of an inch in length, they fall in the spring with the appearance of the new growth. The stipules are oblong-obovate or linear-lanceolate, thin, scarious, light brown, puberulous, from one half to three quarters of an inch long and caducous. The flowers appear early in April, the staminate borne in slender hairy aments two or three inches in length, the pistillate usually on slender peduncles clothed, like their involucral scales, with dense pale tomentum. The calyx of the staminate flower is light yellow, pilose, and divided into lanceolate acute segments rather shorter than the stamens, which are composed of slender filaments and oblong slightly emarginate glabrous yellow anthers. The fruit is sometimes sessile, but more frequently is borne on a slender pubescent stem sometimes three quarters of an inch in length; the nut is oblong, oval, gradually narrowed and acute, or broad, full and rounded at the obtuse apex, broad or narrowed at the base, dark chestnut-brown and more or less conspicuously marked with darker longitudinal stripes, which soon disappear, but turning a light chestnut-brown as it dries, from three quarters of an inch to an inch long and about half an inch broad; the cup, which incloses about a third of the nut, is deep saucer-shaped, broad and flat on the bottom, or is cup-shaped or turbinate; it is light brown and pubescent within and covered on the outer surface by ovate bright

red-brown scales coated with pale tomentum, usually thickened, united, and tuberculate at the base of the cup and produced into small acute ciliate tips near the margin; or sometimes only the lower scales are thickened and the others are thin and furnished with free elongated tips.

Quercus Engelmanni inhabits southwestern California, where, mingling with *Quercus agrifolia*, it is scattered over low hills west of the coast ranges from the neighborhood of Sierra Madre to the mesa east of San Diego, occupying a belt about fifty miles in width and extending to within fifteen or twenty miles of the coast.

The wood of *Quercus Engelmanni* is very heavy, hard, strong, and close-grained, but brittle and difficult to season; it is dark brown or nearly black, with thick lighter brown sapwood, and contains small open cells arranged in numerous groups parallel to the broad and very conspicuous medullary rays. The specific gravity of the absolutely dry wood is 0.9441, a cubic foot weighing 58.84 pounds. It is valued and sometimes used for fuel.

First noticed by Dr. C. C. Parry,[1] this tree was long confounded with *Quercus oblongifolia* of New Mexico and Arizona, from which it was separated by Professor E. L. Greene,[2] who associated with it the name of Dr. George Engelmann.[3]

Quercus Engelmanni is a handsome tree, easily distinguished from the green-leaved evergreen Oak, with which it usually grows, by the blue color of its leaves, and from its nearest botanical congener, *Quercus oblongifolia*, by its darker furrowed bark, its thicker and darker leaves, larger fruit with thicker cup-scales, and yellow cotyledons.

[1] See vii. 130.

[2] Edward Lee Greene was born on the 20th of April, 1842, in Hopkinton, Washington County, Rhode Island. Beginning the study of plants at the age of five, he had gained, with the assistance of Mrs. Lincoln's Botany, a good understanding of the local flora before he was twelve years old, when he went with his family to central Illinois, and, two years later, to southern Wisconsin, where he had the advantage of instruction from the Swedish naturalist, Thurn Kumlien. Having then engaged in teaching for several years, and having tramped repeatedly over almost all the country between Lake Michigan and northern Georgia and Alabama in pursuit of botanical knowledge, Mr. Greene went to Denver, Colorado, in 1870 and became connected with Bishop Randall's new "Jarvis Hall" institution as an instructor in science and a student of theology. He was ordained in the Episcopal Church in 1873, and was stationed successively at Pueblo, Colorado, at Vallejo, California, at Georgetown, Colorado, and then as a missionary in northern California, Arizona, and New Mexico. In 1881 he was called to St. Mark's Church in Berkeley, California, and in 1882 was appointed lecturer, in 1884 instructor, and in 1885 assistant professor of botany in the University of California. In 1884 Mr. Greene renounced the Episcopal faith, and was received into the Roman Catholic Church, and in 1894 was named professor of botany in the Catholic University of America in the City of Washington. In addition to papers in which many new species of plants are proposed, in the *Bulletin of the Academy of Science of California* and in botanical journals, Mr. Greene has published two papers on the Oaks of western America, an incompleted *Flora Franciscana*, parts of a *Manual of the Botany of the Region of San Francisco Bay*, and two volumes of *Pittonia*, a series of papers relating to botany and botanists.

Greenella, an herb discovered by him in southern Arizona, was named in his honor by Asa Gray.

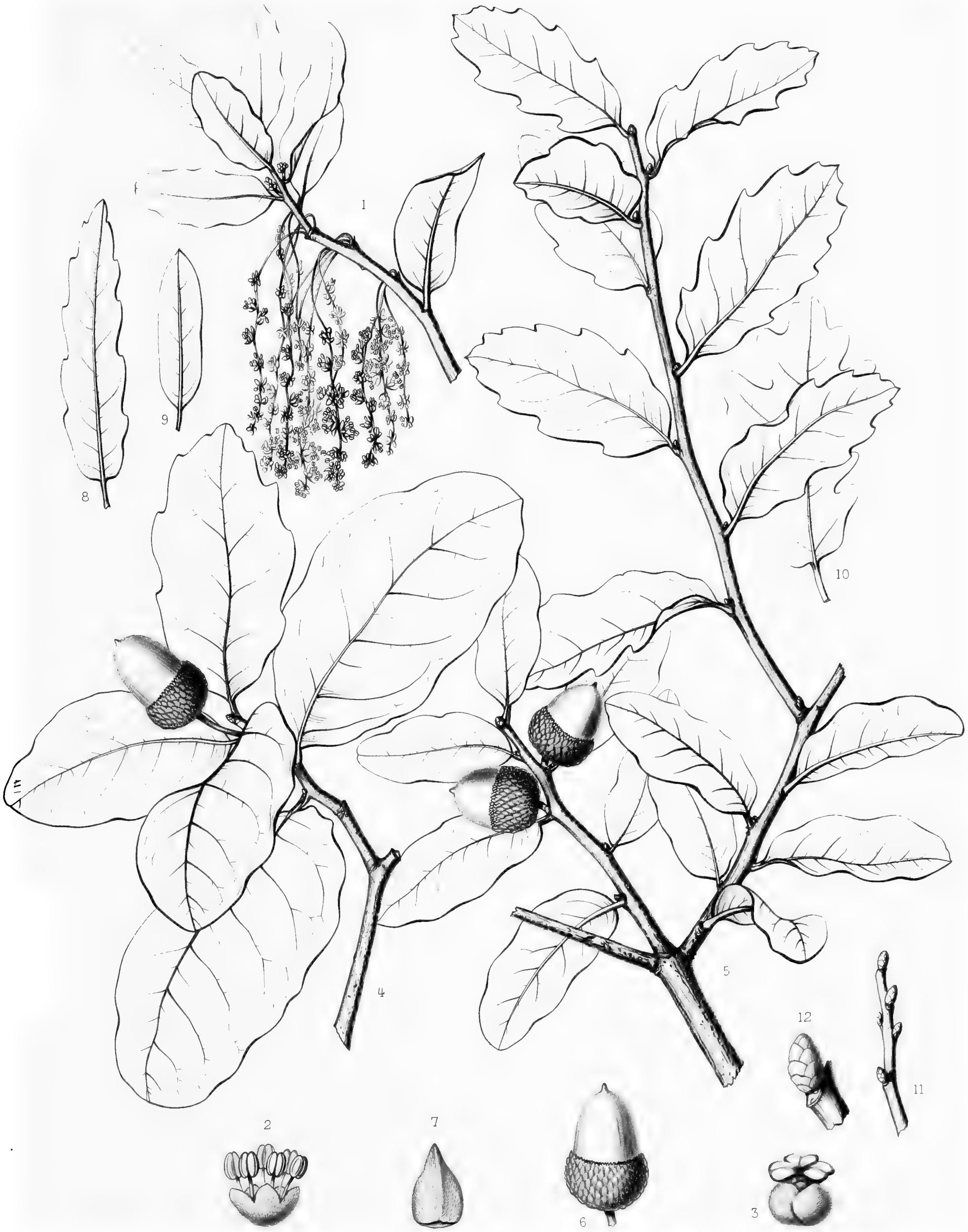
[3] George Engelmann (1809–1884) was born at Frankfort-on-the-Main, where his father, a member of the younger branch of the Engelmann family, which for many generations had furnished clergymen to Bacharach on the Rhine, was likewise a clergyman and the master of a successful school for young ladies. George Engelmann was the oldest of thirteen children. He entered the University of Heidelberg in 1827, and in the following year, owing to some political difficulties at Heidelberg, he joined the Berlin University, where he remained for two years, going thence to Würzburg, where in 1831 he took his degree in the department of medicine, his inaugural thesis, *De Antholysi Prodromus*, a morphological dissertation, being published the following year and attracting some attention. A few months of study having been spent in Paris with Agassiz and Alexander Braun, later the distinguished Berlin botanist, Dr. Engelmann sailed for America, where some members of his family had become interested in land investments in the Mississippi valley. After a long and adventuresome solitary journey through the forests of Arkansas and northern Louisiana, Dr. Engelmann established himself in St. Louis, where he resided during the remainder of his life, engaged in the practice of medicine, which brought him high standing, fame, and wealth, while the few leisure hours snatched from the demands of an absorbing profession were devoted to botany and meteorology. As a botanist, Dr. Engelmann confined himself to mastering by patient study the most difficult groups of flowering plants, studying them year after year, and leaving when his work was done little for the followers in his chosen fields to garner. In this manner he elaborated the Cactaceæ and the North American species of Cuscuta, Juncus, Yucca, Agave, Quercus, Pinus, Abies, and Juniperus. Nearly all his life a closet botanist, working with scanty and often insufficient material in his own herbarium or in those of Europe, which he visited several times for botanical investigations, it was only toward the end of his career that he was able to see with his own eyes living individuals of many of the western plants he had first made known to science.

Those who knew George Engelmann well will never forget this friendly broad-minded, learned, and modest man, his many kindnesses, his practical common sense, his unbounded good nature and good fellowship, or the pleasure of his society. His name is preserved by the yellow-flowered *Engelmannia* of the western plains, dedicated to him by Torrey and Gray, by the handsomest of all Spruce-trees, by a conspicuous Cactus of the deserts and coasts of California, and by many smaller plants; and it will live in honored remembrance as long as the trees of the New World remain a subject of interest to students.

EXPLANATION OF THE PLATE.

Plate CCCLXXXVII. Quercus Engelmanni.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A fruiting branch, natural size.
6. A fruit, natural size.
7. A cup-scale, enlarged.
8. A leaf, natural size.
9. A leaf, natural size.
10. A leaf, natural size.
11. A winter branchlet, the leaves removed, natural size.
12. An axillary winter-bud, enlarged.



C.E.Faxon del. *Lövendal sc.*

QUERCUS ENGELMANNI, Greene.

A.Riocreux direx.t *Imp. J. Taneur, Paris.*

QUERCUS OBLONGIFOLIA.

White Oak.

LEAVES ovate, oval or obovate, usually cordate, entire or remotely spinulose-dentate, pale blue.

Quercus oblongifolia, Torrey, *Sitgreaves' Rep.* 173, t. 19 (1853). — A. de Candolle, *Prodr.* xvi. pt. ii. 36. — Watson, *Pl. Wheeler*, 17. — Engelmann, *Trans. St. Louis Acad.* iii. 393 (excl. hab. California). — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 143 (excl. hab. California). — Coulter, *Contrib. U. S. Nat. Herb.* ii. 416 (*Man. Pl. W. Texas*).

Quercus undulata, var. **oblongata**, Engelmann, *Rothrock Wheeler's Rep.* vi. 250 (1878).

Quercus undulata, δ **grisea**, Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 200 (in part) (1885).

Quercus undulata, var. **grisea**, Greene, *West Am. Oaks*, 29 (in part), t. 15, f. 1 (1889).

A tree, rarely more than thirty feet in height, with a short trunk eighteen or twenty inches in diameter and many stout spreading and often contorted branches which form a handsome round-topped symmetrical head. The bark of the trunk is from three quarters of an inch to an inch and a quarter in thickness, and is ashy gray and checkered with small nearly square or oblong close plate-like scales. The branches are slender, rigid, and marked with pale lenticels; at first they are coated with thick pale or fulvous tomentum which gradually disappears, and during their first winter they are light red-brown, dark brown, or dark orange-color, becoming ashy gray in their second or third year. The winter-buds are subglobose, obtuse, from one sixteenth to one eighth of an inch long, and covered with thin light chestnut-colored scales, those of the inner ranks being coated with thick pale tomentum tinged with red or pink. The leaves are revolute in the bud, ovate, oval or slightly obovate, usually cordate or sometimes rounded at the base, rounded and occasionally emarginate or acute at the apex, which is often furnished with a minute ridged tip, and entire and sometimes undulate, with thickened revolute margins, or occasionally remotely dentate with small callous teeth; or on vigorous shoots or young plants they are oblong, elongated, rounded or wedge-shaped at the narrow base, acute at the apex, and coarsely sinuate or undulate-toothed with gland-tipped teeth, or three-toothed at the broad apex and entire below; when they unfold they are bright red and coated, especially on the lower surface, with hoary tomentum which soon disappears; when they are half grown they are membranaceous, light green, and glabrous, and at maturity are thin and firm in texture, bright blue and lustrous on the upper and paler on the lower surface, from one to two inches long and from one half to three quarters of an inch broad, or on vigorous shoots sometimes from three to four inches long, with prominent pale midribs raised and rounded on the upper side, slender primary veins arcuate and united near the margins, and conspicuous reticulate veinlets; they are borne on stout nearly terete petioles about a quarter of an inch in length, and, remaining on the branches during the winter without change of color, gradually turn yellow in the spring and fall with or just before the appearance of the new growth. The stipules are oblong-obovate or linear-lanceolate, brown and scarious, from half an inch to nearly an inch in length, coated with pale pubescence and caducous. The flowers appear during March and April with the first unfolding of the leaves; the staminate are borne in short aments, their slender stems covered with white tomentum, and the pistillate are usually sessile, or are raised on tomentose peduncles. The calyx of the staminate flower is light yellow, pilose, and divided into five or six laciniately cut or entire acute segments tinged with red above the middle, and shorter than the stamens with slender filaments and ovate emarginate glabrous yellow anthers. The involucral scales of the

pistillate flower are coated with pale tomentum, and the stigmas are bright red. The acorns ripen in the autumn and are usually solitary and sessile, although occasionally they are raised on slender stalks sometimes nearly two inches in length; the nut is ovate, oval or slightly obovate, full and rounded at the apex, which is furnished with a narrow ring of white pubescence, dark chestnut-brown, striate and very lustrous, but soon becoming light brown in drying, from one half to three quarters of an inch long and about one third of an inch broad, with a thin papery shell and dark purple very astringent connate cotyledons; the cup, which embraces about a third of the nut, is shallow, cup-shaped or rarely turbinate, thin, yellow-green and pubescent on the inner surface, and covered by ovate-oblong scales; these are regularly imbricated, slightly thickened on the back, coated with hoary tomentum, and produced into thin acute bright red tips ciliate on their margins with slender white hairs which sometimes form a minute fringe to the rim of the cup.

Quercus oblongifolia is distributed from the Chisos Mountains, in western Texas,[1] through southern New Mexico and Arizona, and ranges southward into northern Mexico. Comparatively rare in Texas, it is abundant on the foothills of all the mountain ranges of New Mexico and Arizona south of the Colorado plateau, at elevations of about five thousand feet, and, with *Quercus Emoryi*, dots the upper slopes of the mesa where narrow cañons open to the plain.

The wood of *Quercus oblongifolia* is very heavy, hard, and strong, but brittle and liable to check badly in drying; it is dark brown or nearly black, with thick brown sapwood, and contains conspicuous medullary rays, the layers of annual growth being hardly distinguishable. Exceedingly difficult to cut and split, it is sometimes used as fuel, but has no other economic value.

Quercus oblongifolia was discovered in western New Mexico in the autumn of 1851, by Dr. S. W. Woodhouse,[2] naturalist of the expedition sent by the government of the United States, under the command of Captain Sitgreaves, to explore the Zuñi and Colorado Rivers. It is a tree of the foothills and one of the most beautiful of the Oaks of the southwest, always easily recognized by its pale checkered bark, its handsome compact round-topped head, and its light blue foliage.

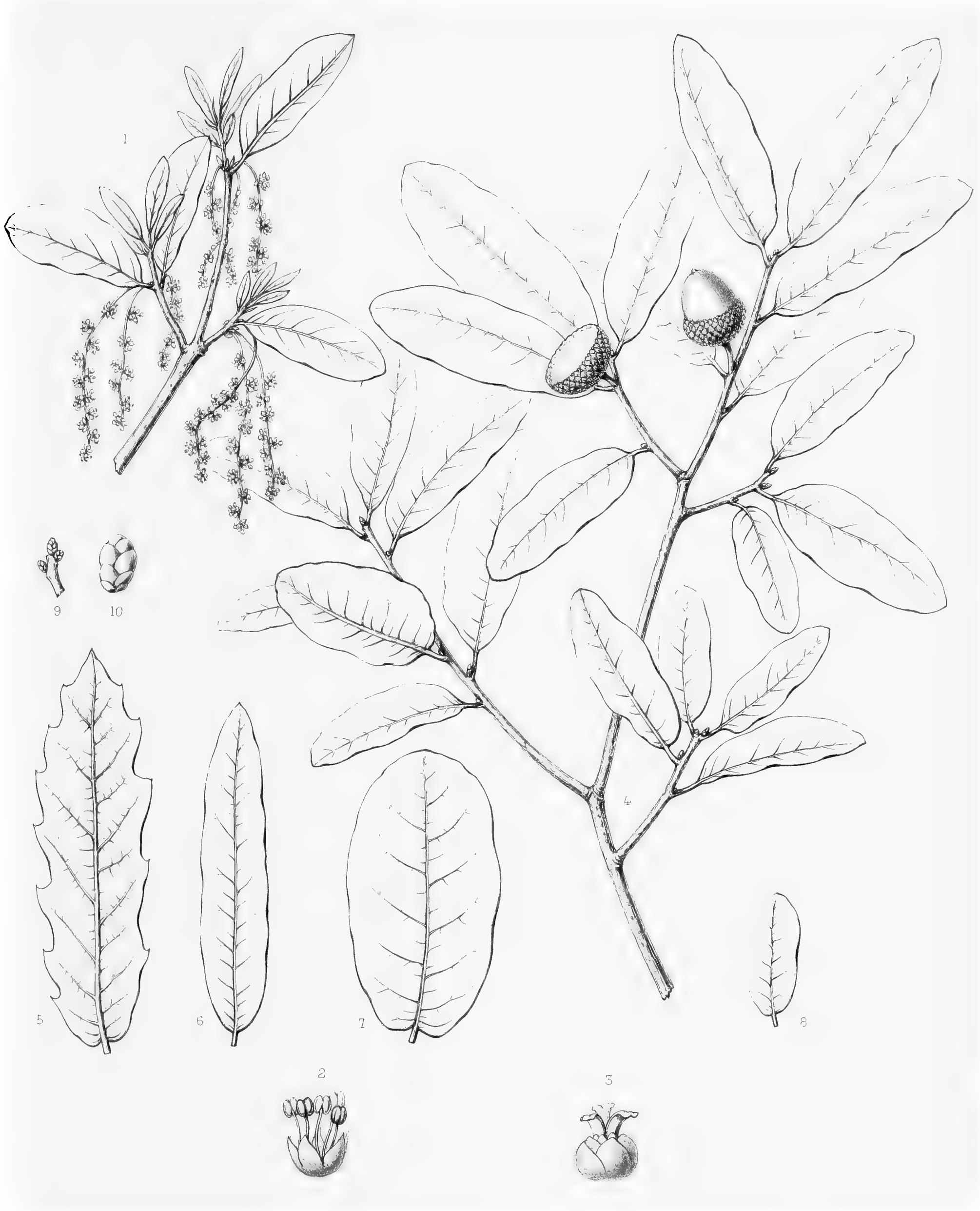
[1] *Quercus oblongifolia* was collected in western Texas by Dr. V. Havard, U. S. Army (*teste* Herb. Engelmann).

[2] Samuel Washington Woodhouse, son of Samuel Woodhouse, a captain in the United States Army, was born June 27, 1821, in Philadelphia, where he was educated, and in 1847 was graduated from the Medical School of the University of Pennsylvania and elected an assistant physician in the Philadelphia Hospital. In 1849 Dr. Woodhouse, who had early developed a love of natural history, especially of ornithology, was appointed surgeon and naturalist of the expedition sent under command of Captain L. Sitgreaves and Lieutenant J. C. Woodruff to establish the boundary of the Creek and Cherokee Nations; a year later he joined the Zuñi exploring party under command of Captain Sitgreaves in the same capacity, and published the account of the mammals and birds included in the general report of this expedition. In 1854 Dr. Woodhouse took part in a scientific expedition to Central America, and two years later resigned his position in the army. The natural history collections made in his long journeys are preserved in the Smithsonian Institution at Washington and in the Philadelphia Academy of Natural Sciences.

EXPLANATION OF THE PLATE.

PLATE CCCLXXXVIII. QUERCUS OBLONGIFOLIA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. Leaf of a vigorous shoot, natural size.
6. A leaf, natural size.
7. A leaf, natural size.
8. A leaf, natural size.
9. The end of a winter branchlet, natural size.
10. A winter-bud, enlarged.



C.E. Faxon del. *Rapine sc.*

QUERCUS OBLONGIFOLIA, Torr.

A. Riocreux dirext. *Imp. J. Taneur, Paris.*

QUERCUS ARIZONICA.

White Oak.

LEAVES oblong-lanceolate to broadly obovate, cordate or rounded at the base, acute or rounded at the apex, spinose-dentate, blue-green, pubescent and conspicuously reticulate-venulose on the lower surface.

Quercus Arizonica, Sargent, *Garden and Forest*, viii. 92 (1895).

Quercus Emoryi, Watson, *Pl. Wheeler*, 17 (not Torrey) (1874).

Quercus undulata, var. **grisea**, Engelmann, *Rothrock Wheeler's Rep.* vi. 250 (not *Quercus grisea*, Liebmann) (1878). — Greene, *West Am. Oaks*, 30 (in part), t. 14.

Quercus grisea, Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 144 (excl. syn.) (not Liebmann) (1884).

A tree, occasionally fifty or sixty feet in height, with a trunk three or four feet in diameter and stout contorted branches spreading nearly at right angles from the stem and forming a handsome round-topped symmetrical head; usually not more than thirty or forty feet tall, and at high elevations sometimes reduced to a low shrub. The bark of the trunk is about an inch thick, and is deeply divided by narrow fissures into broad ridges broken into long thick plate-like scales pale or ashy gray on the surface, that of the young stems and the branches being thinner, pale, and scaly with small appressed scales. The branchlets are stout, and when they first appear are clothed with thick fulvous tomentum which continues to cover them during their first winter, and in their second season they are reddish brown or light orange-color, marked with pale lenticels, and pubescent or puberulous, becoming glabrous and darker the following year. The buds are subglobose, about a sixteenth of an inch long, and covered by loosely imbricated bright chestnut-brown puberulous scales often ciliate on the margins. The leaves are revolute in the bud, oblong-lanceolate to broadly obovate, rounded or cordate at the base, generally acute or sometimes rounded at the apex, and repandly spinose-dentate with minute callous teeth usually, except on vigorous shoots, only above the middle or toward the apex; or they are entire and sometimes undulate; when they unfold they are light red, clothed with bright fulvous or hoary tomentum, and furnished with dark dental glands, and at maturity they are thick, firm and rigid, dark blue-green and glabrous or covered with stellate hairs above, and yellow-green or pale blue and clothed with thick fulvous or pale pubescence below; they are extremely variable in size as well as in shape, varying from an inch to four inches in length and from half an inch to two inches in width, but are usually about two inches long and an inch wide, with yellow midribs broad and thick on the under and slender and raised on the upper side, and slender yellow primary veins arcuate and united near the thickened and slightly revolute margins and connected by coarsely reticulate veinlets; they are borne on stout tomentose slightly flattened petioles from one quarter to one half of an inch in length and fall in the early spring with or just before the appearance of the new growth. The stipules are obovate-oblong or linear-lanceolate, brown and scarious, coated with pale tomentum below and furnished at the apex with clusters of long hairs, and are caducous, or those of the last leaves sometimes persist during the winter. The flowers appear in April; the staminate are borne in short tomentose aments two or three inches in length from the axils of the inner bud-scales of the terminal buds, and the pistillate on short peduncles clothed with thick pale tomentum. The calyx of the staminate flower is pale yellow and pubescent, and is divided into from four to seven broad acute lobes often ciliate on the margins with pale hairs, and shorter than the stamens, which are composed of slender filaments and oblong slightly emarginate red or yellow anthers. The fruit, which is sessile or is sometimes borne on a stout

peduncle covered with hoary tomentum and rarely more than half an inch long, is usually solitary and ripens irregularly from the first of September to the end of November; the nut is oblong, oval or slightly obovate, obtuse and rounded at the puberulous apex, from three quarters of an inch to an inch long, and about half an inch broad, and is dark chestnut-brown, lustrous and often striate when ripe, but soon becomes light brown and losing its stripes as it dries; the cotyledons are connate, dark purple, and very astringent; the cup, which incloses about a third of the nut, is deeply cup-shaped or hemispherical, light brown and pubescent within and covered by regularly and closely imbricated broadly ovate scales coated with thick pale tomentum, furnished with thin light red pointed tips, and below the middle of the cup much thickened and rounded on the back.

Quercus Arizonica is the most common and generally distributed White Oak of southern Arizona and New Mexico, covering with *Quercus Emoryi* the slopes of the cañons of the mountain ranges south of the Colorado plateau [1] at elevations of from five to ten thousand feet above the level of the sea, and many of those of northern Mexico.[2] Growing at the upper edge of the mesa with *Quercus oblongifolia*, it ascends nearly to the summits of the high peaks, where it mingles with *Quercus chrysolepis*, *Quercus Gambelii*, and with Pines and Junipers.

The wood of *Quercus Arizonica* is very heavy, strong, hard, and close-grained, although liable to check badly in drying; it is dark brown or nearly black, with thick lighter colored sapwood, and contains bands of small open ducts marking the layers of annual growth and connected by rows of similar ducts parallel to the numerous conspicuous medullary rays. The specific gravity of the absolutely dry wood is 1.0092, a cubic foot weighing 62.89 pounds. Extremely difficult to cut and split, it is only used for fuel.

Quercus Arizonica,[3] which has been long confounded with one of the Texas forms of *Quercus undulata*, appears to have been first collected in Arizona in 1871 by the party, under command of Lieutenant George M. Wheeler, sent by the government of the United States to explore the territory west of the one hundredth meridian.

To this tree, less beautiful in color, perhaps, than *Quercus oblongifolia*, but always attractive from its pale bark and shapely head of cheerful foliage, is due much of the beauty of the forest-covering of the Arizona Mountains, where *Quercus Emoryi* is the only broad-leaved tree that grows in more abundance.

[1] The sterile branches of a shrubby Oak collected by Coville and Funston in December, 1890 (*Contrib. U. S. Nat. Herb.* iv. 234, No. 4 [*Bot. Death Valley Exped.*]), near Flagstaff, Arizona, on the Colorado plateau, I can refer only to this species, although the region is far north of its range as otherwise known.

An Oak found without flowers and fruit by Brandegee on Mt. San Pedro Martir in Lower California and referred to *Quercus grisea* (*Zoë*, iv. 209) is probably of another species.

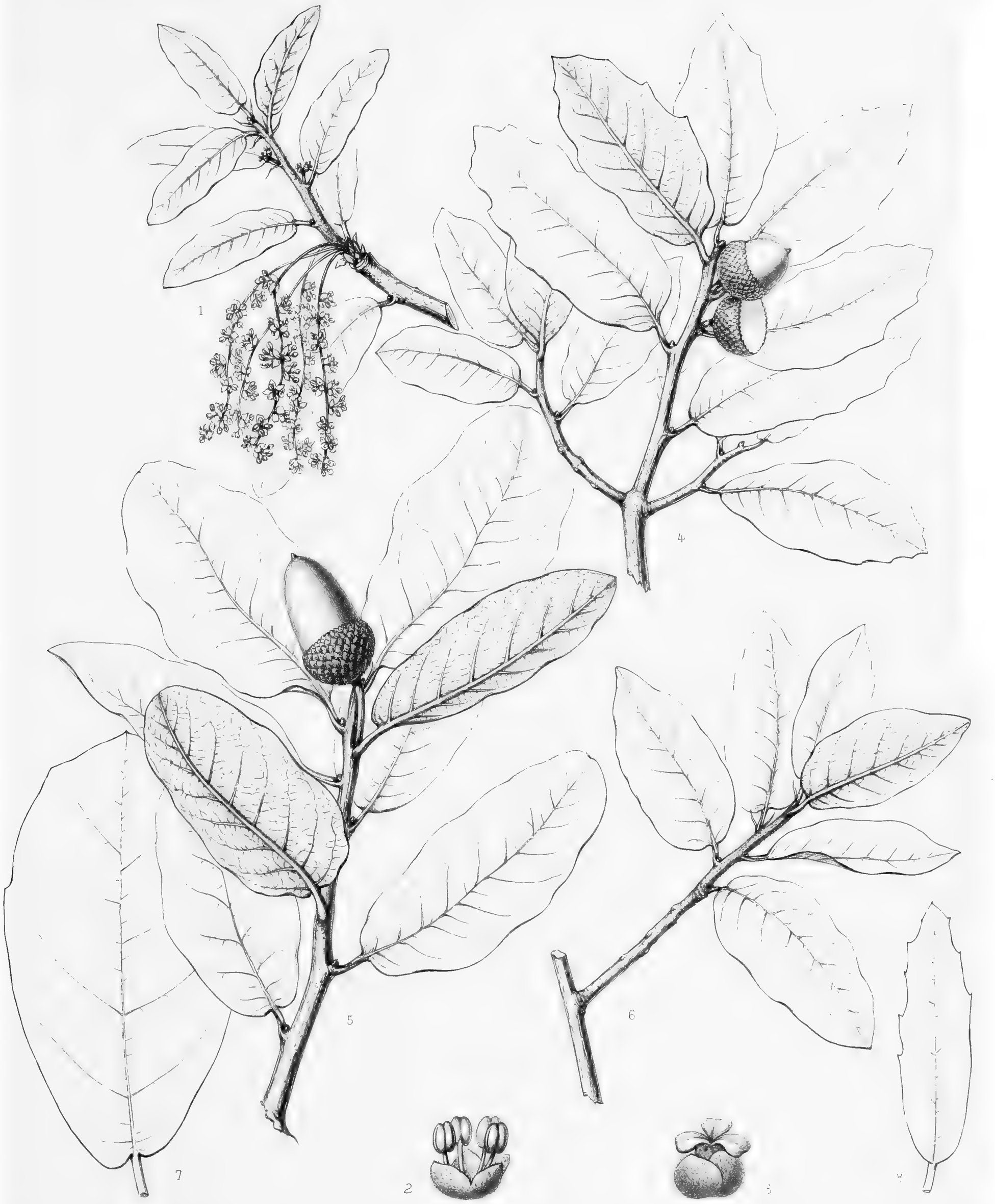
[2] Pringle, *Garden and Forest*, i. 142, 238, 441.

[3] *Quercus Arizonica* is intermediate in many of its characters between *Quercus oblongifolia* and *Quercus reticulata*. Like these species it has purple and astringent seeds, and, like *Quercus oblongifolia*, connate cotyledons. It differs from *Quercus oblongifolia* in its thicker pubescent and much more coarsely reticulate leaves and in its pubescent branchlets and larger fruit with thicker cup-scales. In the texture, pubescence, and coloring of its leaves, and in the shape of some of the large broadly obovate and rounded individual leaves (Plate ccclxxxix. f. 6, 7) which may sometimes be found on branches bearing oblong acute leaves, it resembles *Quercus reticulata*, but its fruit is much larger and has thicker cup-scales than the fruit of that species; its bark is thicker and fissured and generally lighter colored, and in Arizona it grows to a much larger size and at lower altitudes.

EXPLANATION OF THE PLATE.

PLATE CCCLXXXIX. QUERCUS ARIZONICA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A fruiting branch, natural size.
6. A sterile branch, natural size.
7. A leaf, natural size.
8. A leaf, natural size.



C.E. Faxon del. Rapine sc.

QUERCUS ARIZONICA, Sarg.

A. Riocreux direx.t Imp. J. Taneur, Paris.

QUERCUS RETICULATA.

LEAVES broadly obovate, cordate, usually rounded and obtuse at the apex, repandly spinose-dentate, coarsely reticulate-venulose, dark blue-green.

Quercus reticulata, Humboldt & Bonpland, *Pl. Æquin.* ii. 40, t. 86 (1809). — Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* ii. 12. — Kunth, *Syn. Pl. Æquin.* i. 357. — Poiret, *Lam. Dict.* Suppl. v. 609. — Sprengel, *Syst.* iii. 860. — Loudon, *Arb. Brit.* iii. 1944, f. 1865. — Dietrich, *Syn.* v. 308. — A. de Candolle, *Prodr.* xvi. pt. ii. 33. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 67; *Liebmann Chênes Am. Trop.* t. H, t. 34, f. 10–16; t. 35, f. 15–22. — Engelmann, *Trans. St. Louis Acad.* iii. 383; *Rothrock Wheeler's Rep.* vi. 250. — Hemsley, *Bot. Biol. Am. Cent.* iii. 176. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 144. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 194. — Greene, *West Am. Oaks*, 31, t. 16.

Quercus spicata, Humboldt & Bonpland, *Pl. Æquin.* ii. 46, t. 89 (1809). — Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* ii. 13. — Kunth, *Syn. Pl. Æquin.* i. 358. — Bentham, *Pl. Hartweg.* 56.

Quercus decipiens, Martens & Galeotti, *Bull. Acad. Sci. Brux.* x. 214 (1843).

? Quercus reticulata, β Greggii, A. de Candolle, *Prodr.* xvi. pt. ii. 34 (1864). — Hemsley, *Bot. Biol. Am. Cent.* iii. 176.

Quercus reticulata, a large tree in the cañons of the Sierra Madre of Mexico,[1] rarely grows more than thirty feet tall on the mountains of southern Arizona and New Mexico or produces a trunk that exceeds a foot in diameter, and is usually shrubby in habit and sometimes only a few feet high. The bark of the trunk is about a quarter of an inch thick, and is dark or light brown and covered with small thin closely appressed scales. The branchlets, which are stout and marked with pale lenticels, are coated, when they first appear, with thick fulvous tomentum, and during their first winter are light orange-colored and more or less thickly clothed with pubescence, ultimately becoming ashy gray or light brown. The winter-buds are ovate or oval, often accompanied by the persistent stipules of the upper leaves, about an eighth of an inch long and covered by thin loosely imbricated light red scales ciliate on the margins. The leaves are revolute in the bud, broadly obovate, usually cordate or occasionally rounded at the narrow base, obtuse and rounded or rarely acute at the apex, repandly spinose-dentate above the middle or only toward the apex with slender teeth, and entire below; when they unfold they are coated with dense fulvous tomentum, and at maturity are thick, firm and rigid, dark blue and covered with scattered stellate hairs on the upper surface, paler and clothed with thick fulvous pubescence on the lower surface, from one to five inches long and from three quarters of an inch to four inches broad, with stout midribs slightly raised on the upper side and remote primary veins running to the points of the teeth or arcuate and united within the slightly revolute margins, coarse conspicuous reticulate veinlets, and stout petioles about a quarter of an inch in length. The stipules are linear, scarious, light brown, pubescent, and caducous, or those of the last leaves sometimes persist on the branches until the opening of the buds of the following season. The flowers appear in Arizona in May and June, and are borne, the staminate in short tomentose aments from the axils of the leaves of the year, the pistillate in spikes on elongated peduncles clothed, like their involucral scales, with hoary tomentum. The calyx of the staminate flower is light yellow and coated with pale hairs, and is divided into from five to seven ovate acute segments shorter than the stamens, which are composed of slender filaments and smooth ovate emarginate glabrous yellow anthers. The stigmas of the pistillate flowers are dark red. The acorns are borne usually in many-fruited spikes or occasionally in pairs or rarely solitary, on slender hirsute or glabrous peduncles from two to five inches in length and persistent on the branches for one or two years; the nut is oblong, rounded or acute at the pilose apex, broad at the base and about half an inch long, with deep

[1] Pringle, *Garden and Forest*, i. 441.

purple astringent cotyledons; the cup, which incloses about a quarter of the nut, is shallow, cup-shaped, dark brown and pubescent within, and coated with pale or fulvous tomentum on the outer surface, which is covered by small ovate acute scales with thin free scarious tips, and, at the bottom of the cup, slightly thickened and rounded on the back.

The wood of *Quercus reticulata*, which is very heavy, hard, and close-grained, and contains numerous small scattered open ducts and many broad medullary rays, is dark brown with thick lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.9479, a cubic foot weighing 59.07 pounds.

In the United States *Quercus reticulata* was discovered on Mt. Graham, Arizona, at an elevation of nine thousand five hundred feet above the sea by Dr. J. T. Rothrock[1] in 1874. It has also been found near the summits of the Santa Rita, Huachuca, Chiricahua, and Santa Catalina Mountains in Arizona and on the San Luis and Animas Mountains in southern New Mexico.[2]

[1] Joseph Trimble Rothrock was born in McVeytown, Mifflin County, Pennsylvania, on April 9, 1839, and received his early education in Pennsylvania in the Freeland Seminary and in Academia, Juniata County; he then entered the Lawrence Scientific School of Harvard University, from which he was graduated in 1864, and three years later received a degree in medicine from the University of Pennsylvania. He was botanist to a party sent to the Northwest in 1865 to explore a route for a proposed telegraph line across Behring's Sea, and from 1873 to 1875 was surgeon and botanist to the United States Geographical Survey of the country west of the one hundredth meridian, which, under command of Lieutenant George M. Wheeler, explored parts of Colorado, Mexico, Arizona, and California. He largely prepared the volume in which are described the plants collected by him at this time, and is the author of a report on the flora of Alaska, published in the Report of the Secretary of the Smithsonian Institution for 1867. In 1877 Dr. Rothrock was appointed professor of botany in the University of Pennsylvania, and in November, 1892, general secretary of the Pennsylvania Forestry Association.

[2] *Quercus reticulata* was found on the mountains of southern New Mexico in the summer of 1892 by Dr. Edgar A. Mearns, surgeon and naturalist of the International Boundary Commission, growing on their summits as a little shrub and at lower elevations as a small tree with rough whitish bark.

EXPLANATION OF THE PLATE.

PLATE CCCXC. QUERCUS RETICULATA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A fruiting branch, natural size.

C.E. Faxon del.

Rapine sc.

QUERCUS RETICULATA, Humb. & Bonp.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

QUERCUS TOUMEYI.

LEAVES ovate or ovate-oblong or oval, entire or remotely spinose-dentate, blue-green.

Quercus Toumeyi, Sargent, *Garden and Forest*, viii. 92, f. 13, 14 (1895).

A tree, from twenty-five to thirty feet in height, with a short trunk six or eight inches in diameter dividing not far above the ground into several stout wide-spreading branches which form a broad irregular head. The bark of the trunk is about three quarters of an inch in thickness and is deeply furrowed, dark brown tinged with red, and broken on the surface into small thin closely appressed scales. The branchlets are slender, and at midsummer are light rather bright red and more or less thickly coated with pale tomentum, and during their second and third years are covered with thin dark brown nearly black bark broken into small plate-like closely appressed scales. The leaves are ovate or ovate-oblong or oval, rounded or cordate at the base, acute and apiculate at the apex, entire with thickened and slightly revolute margins or remotely spinulose-dentate, or often minutely three-toothed at the apex; they are thin but firm in texture, light blue-green, glabrous and lustrous above, pale and puberulous below, from one half to three quarters of an inch long, from one quarter to one half of an inch wide, and conspicuously reticulate-venulose, with slender midribs raised and rounded on the upper side and thin arcuate primary veins; they are borne on stout tomentose petioles about one sixteenth of an inch long and probably fall early in the spring with the appearance of the new growth. The flowers are unknown. The fruit is sessile, solitary or in pairs, and ripens in June; the nut is oval or ovate, one half or two thirds of an inch long, one quarter of an inch broad, light brown and lustrous, and furnished at the acute apex with a narrow ring of pale pubescence; the abortive ovules are at the base of the seed; the cup, which incloses about a quarter of the nut, is thin and shallow, cup-shaped and tomentose, light green and pubescent within and covered on the outer surface by thin ovate regularly and closely imbricated light red-brown scales ending in short rounded tips and coated on the back with pale tomentum.

The wood of *Quercus Toumeyi* is light brown, with thick pale sapwood, and contains numerous medullary rays and narrow bands of small open ducts marking the layers of annual growth.

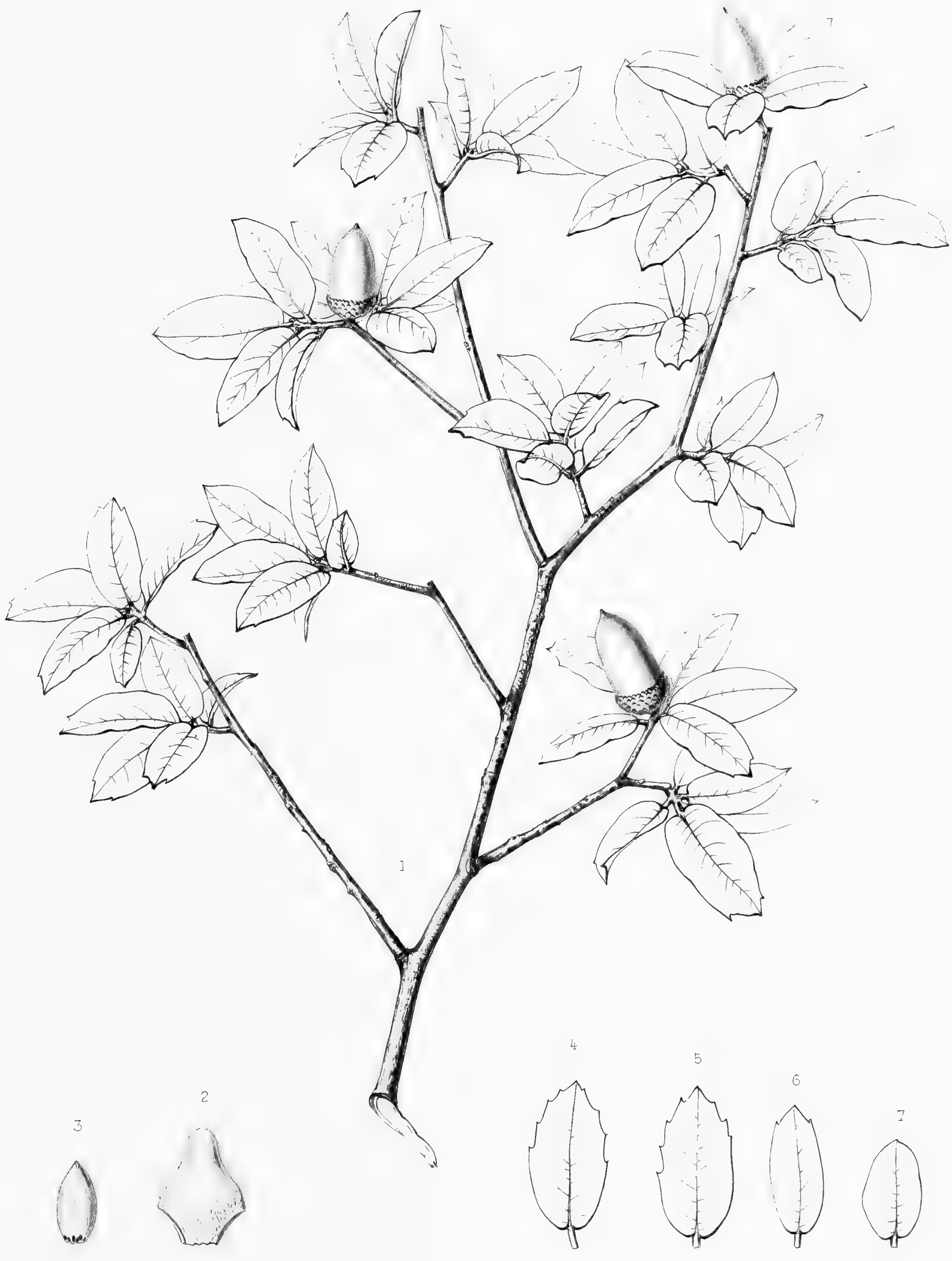
Quercus Toumeyi inhabits the Mule Mountains in Cochise County in southeastern Arizona, where it was found in July, 1894, by Professor J. W. Toumey,[1] forming stunted open forests extending from the belt of *Quercus Emoryi* to the summits.

[1] James William Toumey was born in Van Buren County, Michigan, April 17, 1865, and was graduated from the Michigan Agricultural College in 1889, becoming a year later an assistant in the botanical department of that institution. In 1891 he was appointed professor of botany and entomology in the University of Arizona. Professor Toumey has made large collections of Arizona plants gathered in different parts of the territory, which he has explored botanically more thoroughly than any one else.

EXPLANATION OF THE PLATE.

PLATE CCCXCI. QUERCUS TOUMEYI.

1. A fruiting branch, natural size.
2. A cup-scale, enlarged.
3. A seed, natural size.
4. A leaf, natural size.
5. A leaf, natural size.
6. A leaf, natural size.
7. A leaf, natural size.



C.E.Faxon del. Himely sc.

QUERCUS TOUMEYI, Sarg.

A.Riocreux direx.t Imp. J. Taneur, Paris.

QUERCUS DUMOSA.

Scrub Oak.

LEAVES oblong or obovate, entire, sinute-toothed or lobed, green, pubescent, and often pale on the lower surface.

Quercus dumosa, Nuttall, *Sylva*, i. 7 (1842). — Torrey, *Bot. Mex. Bound. Surv.* 207. — Engelmann, *Trans. St. Louis Acad.* iii. 382 (excl. syn. *Quercus berberidifolia*), 393; *Brewer & Watson Bot. Cal.* ii. 96. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 203. — Greene, *Bull. Cal. Acad.* ii. 412; *West Am. Oaks*, 35, t. 18, 19; *Man. Bot. Bay Region*, 302. — Merriam, *North American Fauna*, No. 7, 334 (*Death Valley Exped.* ii.). — Coville, *Contrib. U. S. Nat. Herb.* iv. 197 (*Bot. Death Valley Exped.*). — Sargent, *Garden and Forest*, viii. 93.

Quercus acutidens, Torrey, *Bot. Mex. Bound. Surv.* 207, t. 51 (1858).

Quercus undulata, var. **pungens**, Engelmann, *Brewer & Watson Bot. Cal.* ii. 96 (in part) (1880).

Quercus dumosa, γ acutidens, Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 204 (1885).

Quercus MacDonaldi, Greene, *West Am. Oaks*, 25 (1889); pt. ii. 73, t. 34. — Sargent, *Garden and Forest*, ii. 471.

Quercus MacDonaldi, var. **elegantula**, Greene, *West Am. Oaks*, 25 (1889); pt. ii. 61, t. 29. — Parish, *Zoë*, iv. 346.

Quercus dumosa, var. **polycarpa**, Greene, *West Am. Oaks*, 36 (1889); pt. ii. 61, t. 28.

Quercus dumosa, var. **munita**, Greene, *West Am. Oaks*, 37, t. 20 (1889).

Quercus turbinella, Greene, *West Am. Oaks*, 37 (1889); pt. ii. 59 (in part), t. 27.

An intricately branched rigid shrub, with stout stems covered by pale gray bark, usually from six to eight feet in height, often forming dense thickets; or occasionally in the sheltered cañons of the California islands rising to the height of twenty-five or thirty feet, with a trunk from twelve to eighteen inches in diameter covered by bright brown scaly bark, and a round-topped head of slender branches. The branchlets are slender, marked with scattered pale lenticels, and coated when they first appear with hoary tomentum; during their first winter they are ashy gray or light or dark reddish brown and usually pubescent or tomentose. The winter-buds are oval, generally acute, from a sixteenth to an eighth of an inch long, and covered by thin pale red scales often pilose and ciliate. The leaves are convolute in the bud, and when they unfold are thin, clothed with scattered stellate hairs or rarely tomentose on the upper surface, and coated on the lower and on the petioles with hoary tomentum; and at maturity they are thick and firm, dark green and rather lustrous above and paler and covered more or less thickly with pubescence below. The leaves of no other North American Oak vary so much in shape; often on the mainland they are oblong, broad and abruptly wedge-shaped or rounded at the base, rounded or acute at the apex, sinuate, spinescent-toothed or entire or occasionally lobed, and usually about three quarters of an inch long and half an inch broad, with obscure midribs and primary veins, conspicuous reticulate veinlets, and short stout petioles rarely more than an eighth of an inch in length; generally furnished with a few small remote spinescent teeth, oblong-obovate leaves, and leaves with undulate and entire or coarsely spinescent margins are common on individual plants, and leaves of all these forms may be found on the same plant; small lobed leaves are not uncommon on plants near the coast, but are most abundant on the islands, where individual plants frequently produce oblong or oblong-obovate leaves narrowed at the base into long slender petioles and divided by deep sinuses rounded at the bottom into from five to nine oblong lobes, these being acute, rounded or emarginate and bristle tipped, and increasing in size from the base of the leaf to the apex, which is three-lobed, rounded or acute; such leaves are sometimes from two to four inches long and from an inch to an inch and a half wide, with stout midribs, primary veins running to the points of the leaves, and obscure reticulate veinlets; and, borne on petioles varying from three quarters of an inch to an inch in length, they appear to fall

earlier in the winter than the smaller dentate or entire leaves on mainland plants.[1] The stipules are linear, obovate or lanceolate, scarious, light brown, coated with pale hairs and caducous. The flowers are produced in early spring with the unfolding of the leaves; the staminate are borne in pubescent aments about three inches in length, and the pistillate are sessile or pedunculate; or rarely the flowers are perfect in long many-flowered tomentose spikes.[2] The calyx of the pistillate flower is divided into from four to eight ovate lanceolate hairy segments much shorter than the stamens, which are composed of slender filaments and ovate emarginate glabrous yellow anthers. The involucral scales and the calyx of the pistillate flower are clothed with pale tomentum, and the stigmas are red. The acorns are usually solitary, and are sessile or short-pedunculate; the nut is oval, broad at the base, broad and rounded or narrowed and acute at the apex, from half an inch to an inch and a half long and from one third to nearly two thirds of an inch broad; the cup, which incloses from one third to nearly two thirds of the nut, is deeply cup-shaped or hemispherical; it is light brown and pubescent within, and is covered by ovate pointed scales coated with pale or rufous tomentum; these, except on the upper part of the cup, are generally much thickened, united and tuberculate, and are sometimes furnished with thin free acute tips; above they are small and thin with minute free hairy tips which form a slight fringe to the rim of the cup, or frequently the basal scales are scarcely or not at all thickened and are furnished with larger free tips.

In northern California, and occasionally in southern California, a variety of *Quercus dumosa*[3] occurs with rounder, thicker, and paler leaves, which are concave and covered with hoary tomentum or are glabrous on the upper surface and strongly revolute with entire or spinescent margins, and usually with less pointed nuts and rather shallower cups.

Quercus dumosa is sometimes found on the western slopes of the Sierra Nevada Mountains in California;[4] it is common on the coast ranges south of San Francisco Bay, inhabits the islands off the coast of the southern part of the state, where it grows to its largest size, and extends inland to the borders of the Mohave Desert and the cañons of the desert slopes of the San Bernardino and San Jacinto Mountains, ranging southward in Lower California to the hills near San Telmo.[5] North of San Francisco Bay it is replaced by the variety *revoluta*, which ranges as far north as Mendocino County and to Napa Valley.

Quercus dumosa was discovered by Thomas Nuttall on the hills near Santa Barbara in the spring of 1835.

[1] No one could imagine simply from an examination of herbarium specimens that the insular form, with lobed leaves (Plate cccxciii. f. 1, 4) resembling those of some forms of *Quercus Gambelii*, could belong to this species. When the plants, however, are seen in the cañons of Santa Catalina Island it becomes apparent that the occasional trees with large lobed leaves are only more vigorous individuals of a species which in the same thickets produce small and entire or spinescent or slightly lobed leaves; in these thickets individual plants bear entire, spinescent, and variously lobed large and small leaves on the same or on different branches, and vigorous shoots on plants with otherwise mostly small entire leaves often bear large lobed leaves; and these large-leaved individuals seen from a little distance cannot be distinguished by habit, color, or general appearance from their smaller leaved associates. Half a dozen species or well marked varieties might be established from as many isolated branches selected from plants of *Quercus dumosa* on Santa Catalina Island (Plate cccxciii.), and all their characters might be found on a single plant.

A low shrubby form (*Quercus turbinella*) from the two mountain-slopes on both sides of the Mexican boundary, with oblong acute entire or dentate thick and rigid leaves about three quarters of an inch long, slender elongated nuts and comparatively shallow cups with thin scales, appears distinct in extreme forms, but more spinescent leaved forms with thicker and more tuberculate cups grow with it, and I cannot find varietal characters by which to separate them. I have not seen this plant alive.

[2] A monstrous condition (*Quercus dumosa polycarpa*) noticed by Professor Greene, who believed it to be a second flowering from a second annual growth.

[3] *Quercus dumosa*, var. *revoluta*, Sargent, *Garden and Forest*, viii. 93 (1895) (Plate cccxcii. f. 5, 6).

Quercus dumosa, var. *bullata*, Engelmann, *Trans. St. Louis Acad.* iii. 393 (not *Quercus Robur bullata*, A. de Candolle) (1877); *Brewer & Watson Bot. Cal.* ii. 96. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 204. — Greene, *Man. Bot. Bay Region*, 302.

[4] A common small-leaved form of *Quercus dumosa* was collected at Sherlock, in Mariposa County, by Mr. J. W. Congdon, in the spring of 1894.

[5] Brandegee, *Zoë*, iv. 209.

EXPLANATION OF THE PLATES.

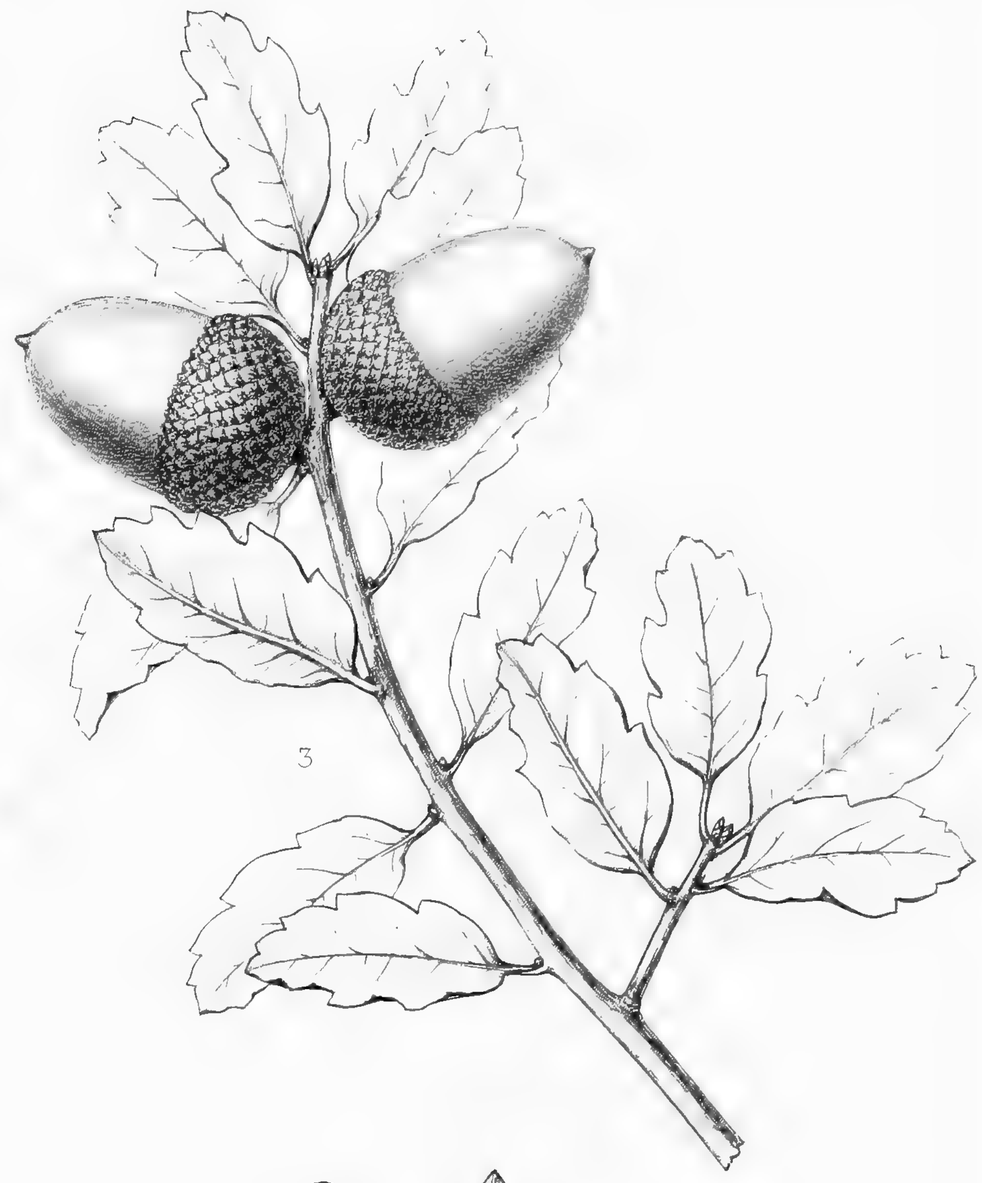
Plate CCCXCII. Quercus dumosa.

1. A flowering branch, natural size.
2. A staminate flower, natural size.
3. A fruiting branch, natural size.
4. A fruiting branch of the variety *revoluta*, natural size.
5. The end of a branch of the variety *revoluta*, with nearly entire leaves.
6. A fruit, natural size.
7. A fruit, natural size.
8. A fruit, natural size.

Plate CCCXCIII. Quercus dumosa.

1. A fruiting branch, natural size.
2. A fruiting branch, natural size.
3. The end of a vigorous shoot with sharply dentate leaves.
4. A leaf, natural size.
5. A leaf, natural size.
6. A leaf, natural size.
7. A leaf, natural size.
8. A fruit, natural size.
9. A fruit, natural size.
10. A fruit, natural size.
11. A fruit, natural size.
12. A winter branchlet, natural size.

1



3

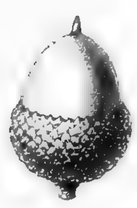
4

5

2

6

7



8

C.E. Faxon del.

Rapine sc.

QUERCUS DUMOSA, Nutt.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

C.E.Faxon del. *Migneaux sc.*

QUERCUS DUMOSA, Nutt.

A.Riocreux direx.t *Imp. J.Taneur, Paris.*

QUERCUS VIRGINIANA.

Live Oak.

LEAVES oblong, elliptical or obovate, entire or remotely spinose-dentate, pale or silvery white on the lower surface.

Quercus Virginiana, Miller, *Dict.* ed. 8, No. 16 (1768). — Evelyn, *Silva*, ed. Hunter, i. 72. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 426. — Koch, *Dendr.* ii. pt. ii. 57. — Dippel, *Handb. Laubholzk.* ii. 91, f. 39. — Sudworth, *Rep. Sec. Agric. U. S.* 1892, 328. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 416 (*Man. Pl. W. Texas*).

Quercus Phellos, β, Linnæus, *Spec.* 994 (1753).

Quercus Phellos, c, Muenchhausen, *Hausv.* v. 255 (1770).

Quercus Phellos, γ **obtusifolia**, Lamarck, *Dict.* i. 722 (1783).

Quercus Phellos sempervirens, Marshall, *Arbust. Am.* 124 (1785). — Castiglioni, *Viag. negli Stati Uniti*, ii. 345.

Quercus sempervirens, Walter, *Fl. Car.* 234 (not Miller) (1788).

Quercus virens, Aiton, *Hort. Kew.* iii. 356 (1789). — Michaux, *Hist. Chênes Am.* No. 6, t. 10; *Fl. Bor.-Am.* ii. 196. — Willdenow, *Spec.* iv. pt. i. 425; *Enum.* 974. — Persoon, *Syn.* ii. 567. — Borkhausen, *Handb. Forstbot.* i. 718. — Bosc, *Mém. Inst. Nat. Sci. Phys. Math.* viii. pt. i. 342. — Desfontaines, *Hist. Arb.* ii. 507. — Poiret, *Lam. Dict.* Suppl. ii. 213. — Stokes, *Bot. Mat. Med.* iv. 404. — Michaux f. *Hist. Arb. Am.* ii. 67, t. 11. — Pursh, *Fl. Am. Sept.* ii. 626. — Nuttall, *Gen.* ii. 214; *Sylva*, i. 16. — *Nouveau Duhamel*, vii. 151. — Elliott, *Sk.* ii. 595. — Sprengel, *Syst.* iii. 858. — Spach, *Hist. Vég.* xi. 177. — Scheele, *Roemer Texas*, 446; *Linnæa*, xxii. 147. — Dietrich, *Syn.* v. 307. — Torrey, *Bot. Mex. Bound. Surv.* 206. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 35. — Chapman, *Fl.* 421. — A. de Candolle, *Prodr.* xvi. pt. ii. 37. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 69; *Liebmann Chênes Am. Trop.* t. 33, f. 50–57. — Vasey, *Am. Ent. and Bot.* 282, f. 175. — Engelmann, *Trans. St. Louis Acad.* iii. 383. — Hemsley, *Bot. Biol. Am. Cent.* iii. 178. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 145. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 181. — Houba, *Chênes Am. en Belgique*, 302, t. — Watson & Coulter, *Gray's Man.* ed. 6, 477.

Quercus oleoides, Chamisso & Schlechtendal, *Linnæa*, v. 79 (1830). — Martens & Galeotti, *Bull. Acad. Sci. Brux.* x. 208. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 69. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 218.

Quercus Sagræana, Nuttall, *Sylva*, i. 17 (1842).

Quercus Cubana, A. Richard, *Fl. Cub.* iii. 230 (1853).

Quercus retusa, Liebmann, *Oversigt Dansk. Vidensk. Selsk. Forhandl.* 1854, 187. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 69.

A tree, forty or fifty feet in height, with a trunk three or four feet in diameter above its swollen and buttressed base, and usually dividing a few feet from the ground into three or four great horizontal wide-spreading limbs which form a low dense round-topped head often covering an area from one hundred to one hundred and fifty feet across; occasionally sixty or seventy feet tall, with a trunk diameter of six or seven feet, but often shrubby, and sometimes not more than a foot high. The bark of the trunk and large branches is from half an inch to an inch in thickness and is dark brown tinged with red and slightly furrowed, the surface separating into small closely appressed scales. The branchlets are slender, rigid, marked with pale lenticels, and coated at first with hoary tomentum which soon begins to disappear, and during their first winter are ashy gray or light brown and pubescent or puberulous, becoming darker and glabrous the following season. The winter-buds are globose or slightly obovate, about one sixteenth of an inch long, and covered by thin light chestnut-brown scales with scarious white margins. The leaves are revolute in the bud, oblong, elliptical or obovate, gradually narrowed and wedge-shaped or, in Texas and Mexico, sometimes rounded or cordate at the base, rounded or acute at the apex, and usually entire with thickened and conspicuously revolute margins, or rarely furnished above the middle with a few rigid spinose teeth; when they unfold they are thin, light green tinged with red, covered with scattered pale stellate hairs on the upper surface, and coated on the lower with thick hoary tomentum; and at maturity they are thick and coriaceous, very dark green and lustrous above, pale or silvery white and pubescent or puberulous below, from two

to five inches in length and from half an inch to two inches and a half in breadth, with narrow yellow midribs, few slender obscure primary veins forked and united at some distance from the margins, and conspicuous or inconspicuous reticulate veinlets; they are borne on stout petioles, grooved and flattened on the upper side and rarely more than a quarter of an inch long, and, gradually turning yellow or brown at the end of the winter, fall with or soon after the appearance of the new growth in the spring. The stipules are linear-obovate or lanceolate, hairy, brown and scarious, and about half an inch in length. The flowers appear in March and April, and are borne, the staminate in the axils of linear-lanceolate pubescent bracts in hairy aments from two to three inches in length, the pistillate in spikes on slender pubescent peduncles from one to three inches long. The calyx of the staminate flower is light yellow, hairy, and divided into from five to seven ovate rounded segments shorter than the stamens, which are composed of slender filaments about as long as the large oblong emarginate hirsute yellow anthers. The involucral scales and ovate calyx-lobes of the pistillate flower are coated with hoary pubescence, and the stigmas are bright red. The fruit is usually produced in from three to five-fruited spikes, or sometimes in pairs or singly, on stout light brown puberulous peduncles marked with pale lenticels, enlarged toward the apex, and from one to five inches in length; the nut is oval or slightly obovate, narrowed at the base, rounded or acute at the narrow apex, dark chestnut-brown and very lustrous, and about an inch long and one third of an inch wide, with a sweet seed and light yellow connate cotyledons; the cup, which incloses about a quarter of the nut, is turbinate, light reddish brown and puberulous within, and covered with thin ovate acute scales slightly keeled on the back, coated with dense lustrous hoary tomentum and produced into small closely appressed reddish tips. In germinating, the petioles of the cotyledons grow from one to two inches long, the plumule forcing its way up through a slit near their base; the radicle and the upper part of the fruit, by absorbing the sweet and starchy matter contained in the cotyledons, enlarges and forms a spindle-shaped tuber often two inches long which furnishes the young plant with an immediate supply of nourishment and, when this function has been performed, becomes merged with the root.[1]

Quercus Virginiana is distributed from the shores of Mobjack Bay in Virginia southward on the islands and in the neighborhood of the coast to those of Bay Biscayne in Florida; it abounds in all parts of the Florida peninsula, and, ranging from Cape Romano along the shores of the Gulf of Mexico to beyond the mouth of the Rio Grande, spreads inland through Texas to the valley of the Red River and to the Apache and Guadaloupe Mountains in the extreme western part of the state, and to the mountains of northeastern Mexico; it inhabits the island of Cuba and the mountains of southern Mexico, Central America, and Lower California.[2] On the Atlantic and east Gulf coasts, where it is very abundant and attains its largest size, the Live Oak grows on rich hummocks and ridges a few feet above the level of the ocean with the Water Oaks, the Hickories, the Red Bay, and the Mulberry; it is abundant in Texas, growing in the coast region near the banks of streams in low rich soil, and farther westward toward the valley of the Rio Grande often forming on low moist soil the principal part of the shrubby growth.

In sandy barren soil in the immediate vicinity of the coast, or on the shores of salt water estuaries and bays, the Live Oak is often a shrub with numerous stout contorted stems and thick rigid branchlets. Such shrubby forms bear leaves which, except in their smaller size, resemble the leaves of the large trees, or on some individuals the leaves are thin and but slightly or not at all revolute and frequently not more than an inch in length,[3] and on others, sometimes bearing fruit on stems not more than a foot high, they are obovate-oblong, often spinosely toothed, three or four inches long and

[1] Engelmann, *Trans. St. Louis Acad.* iv. 190.

These tubers are eagerly sought for and eaten by the negro children in the southern states.

[2] *Quercus Virginiana* was collected by Mr. T. S. Brandegee at Miraflores, Lower California, November 14, 1890.

[3] *Quercus Virginiana*, var. *maritima*.

Quercus Phellos (*maritima*), Michaux, *Hist. Chênes Am.* No. 7, t. 13, f. 3 (1801).

Quercus maritima, Willdenow, *Spec.* iv. pt. i. 424 (1805). — Nuttall, *Gen.* ii. 214; *Sylva*, i. 13.

Quercus virens, var. *maritima*, Chapman, *Fl.* 421 (1860). — Engelmann, *Trans. St. Louis Acad.* iii. 383.

half an inch wide. On one form [1] growing from one to two feet high and spreading by underground stems, which is common in the sterile Pine barrens of the south Atlantic and eastern Gulf coasts, the lower leaves are oblong-obovate, gradually narrowed at the base, acute at the broad apex, coarsely repand-serrate with large triangular spreading or oblique teeth, or three-toothed at the apex and entire below, and three or four inches long, while the upper leaves are oblong-lanceolate with entire slightly revolute margins. On these dwarf forms the fruit is usually larger and borne on shorter peduncles than that of large trees.

Quercus Virginiana is one of the most valuable timber-trees of North America. The wood is very heavy, hard, strong, tough, and close-grained, with a satiny surface susceptible of receiving a beautiful polish, but is rather difficult to work; it is light brown or yellow, with thin nearly white sapwood, and contains numerous small open ducts arranged in short broken rows parallel to the broad conspicuous medullary rays, the layers of annual growth being hardly distinguishable. The specific gravity of the absolutely dry wood is 0.9501, a cubic foot weighing 59.21 pounds. Formerly it was largely used in ship-building, and is still occasionally employed for this purpose.[2]

The sweet acorns were gathered and eaten by the Indians, and afford valuable food for hogs.[3]

The importance of the Live Oak as a timber-tree was recognized in the seventeenth century,[4] and the first description of it was published by Plukenet in 1696.[5] It was cultivated by Philip Miller in

[1] *Quercus Virginiana*, var. *minima* (Plate cccxcvi.).

Quercus virens, var. *dentata*, Chapman, *Fl.* 421 (not *Quercus dentata*, Thunberg) (1860).

[2] The President of the United States having been authorized by an Act of Congress approved March 27, 1794, to procure four ships of war for the purpose of protecting American commerce against the attacks of Algerian pirates, the attention of the government was called to the value of Live Oak timber in ship-building (see *Am. State Papers* [Docs. Legislative and Executive], i. 8). Writing on the 11th of January, 1797, to the committee on naval questions, James McHenry, Secretary of War, argued that "early precaution should be taken to secure to the United States a lasting fund of live oak for future use" (*ibid.* 27); and by an Act of Congress approved February 25, 1799, $200,000 were appropriated by Congress for the purpose of purchasing growing or other timber or lands on which timber was growing suitable for the navy. Under this act, Grover Island, of three hundred and fifty acres, on the Georgia coast, was purchased by the President for $7,500 in December, 1799; and in the following year Blackbeard Island, of sixteen hundred acres, also on the Georgia coast, was bought for $15,000. The acquisition of Louisiana by the United States increased the available supply of live oak, and on the 1st of March, 1817, an act was passed authorizing the withdrawal from entry of lands in the new territory covered with Live Oak and Cedar suitable for naval construction which might be designated by the President. Under this act Cypress and Six Islands in Louisiana, of about nineteen thousand acres in extent and estimated to contain thirty-seven thousand Live Oaks suitable for naval use, were reserved. The ceding of Florida to the United States called attention to the value of its Live Oak trees and to the great quantities of this timber that were exported annually from the St. John's River to foreign countries. The land was so covered by private titles, however, that no timber-land could be reserved in the new territory until 1825, when Congress appropriated $10,000 to purchase land on Santa Rosa Sound and cultivate Live Oak timber. The cultivation appears to have consisted chiefly in clearing the ground about young trees to improve their growth. Attempts to transplant seedlings were not successful, but large quantities of nuts were planted and experiments in pruning young trees were made.

Under the Act of 1817, 208,224 acres of Live Oak land in western Florida, including the island of Santa Rosa, were withdrawn from entry on October 23, 1830; two years later the reservations were increased by 26,218 acres on the coast of Mississippi, including Round Island, and by two hundred and forty acres in southern Alabama; on October 21, 1845, 9,170 acres in three islands on the coast of Louisiana were added to the reservations.

Previous to the War of Secession large quantities of Live Oak timber were cut from the reservations and used in the construction of war-ships or stored in the shops of the different navy-yards, but the substitution of iron for wood in naval architecture diminished their value, and they were gradually neglected and occupied by squatters who cleared the land for agricultural purposes. On March 3, 1879, an act was passed providing that all lands in Florida reserved for the use of the navy should be restored to the public domain; no action was taken under this authority, however, but under an act passed by the Fifty-third Congress, approved in February, 1895, all the naval timber reservations in Louisiana, Mississippi, and Alabama were transferred by the Secretary of the Navy to the Secretary of the Interior on the 15th of March, 1895, and opened to the public for entry and occupation, the Florida reservations being still retained by the Navy Department for further investigations.

[3] "It bears a prodigious quantity of fruit; the acorn is small, but sweet and agreeable to the taste when roasted, and is food for almost all animals. The Indians obtain from it a sweet oil, which they use in the cooking of hommony, rice, &c., and they also roast them in hot embers, eating them as we do chesnuts." (W. Bartram, *Travels*, 85.)

[4] "*Trees* for the Service of building Houses and Shipping, besides those and many more which we have not nam'd; they have all such as we in *England* esteem Good, Lasting and Serviceable, as the Oak of three sorts, the White, Black and Live Oak, which for Toughness and the Goodness of its Grain is much esteemed." (Thomas Ash, *Carolina, or a Description of the Present State of that Country*, 10.)

[5] *Quercus Virginiana sempervirens, foliis oblongis sinuatis, & non sinuatis, Alm. Bot.* 310. — Ray, *Hist. Pl.* iii. *Dendr.* 8.

Quercus sempervirens, foliis oblongis non sinuatis, Catesby, *Nat. Hist. Car.* i. 17, t. 17.

the Physic Garden at Chelsea, near London, in 1739,[1] and, although now rare in European plantations,[2] the Live Oak is said to have produced fruit in the King's Garden at Kew early in the present century.[3] In the southern United States its beauty has been appreciated for more than two hundred years; and noble single specimens or avenues of Live Oaks guarding the approaches to the stately colonial mansions of Carolina and Georgia, and unsurpassed in majesty by planted trees of any other kind, testify to the ornamental value of this species, which surpasses the other Oaks of North America in grandeur of port, beauty of outline, and solidity of trunk and branches.[4] No American Oak grows more rapidly[5] or is more easily transplanted, and its general use as a shade-tree, with the scarcely less beautiful Laurel Oak, in the streets of southern cities, gives them their greatest charm.

[1] Loudon, *Arb. Brit.* iii. 1918, f. 1802, 1803, t.

[2] Nicholson, *Garden and Forest*, i. 136.

[3] Cobbett, *Woodlands*, No. 446.

[4] Sargent, *Garden and Forest*, i. 476, f. 74. — Lamborn, *Garden and Forest*, v. 483, f. 82, 83. — *Garden and Forest*, vi. 2, f. 2.

[5] The log specimen in the Jesup Collection of North American Woods in the American Museum of Natural History, New York, obtained from northern Florida, is eighteen inches in diameter inside the bark, with sixteen layers of sapwood, and is only forty-four years old.

EXPLANATION OF THE PLATES.

Plate CCCXCIV. Quercus Virginiana.

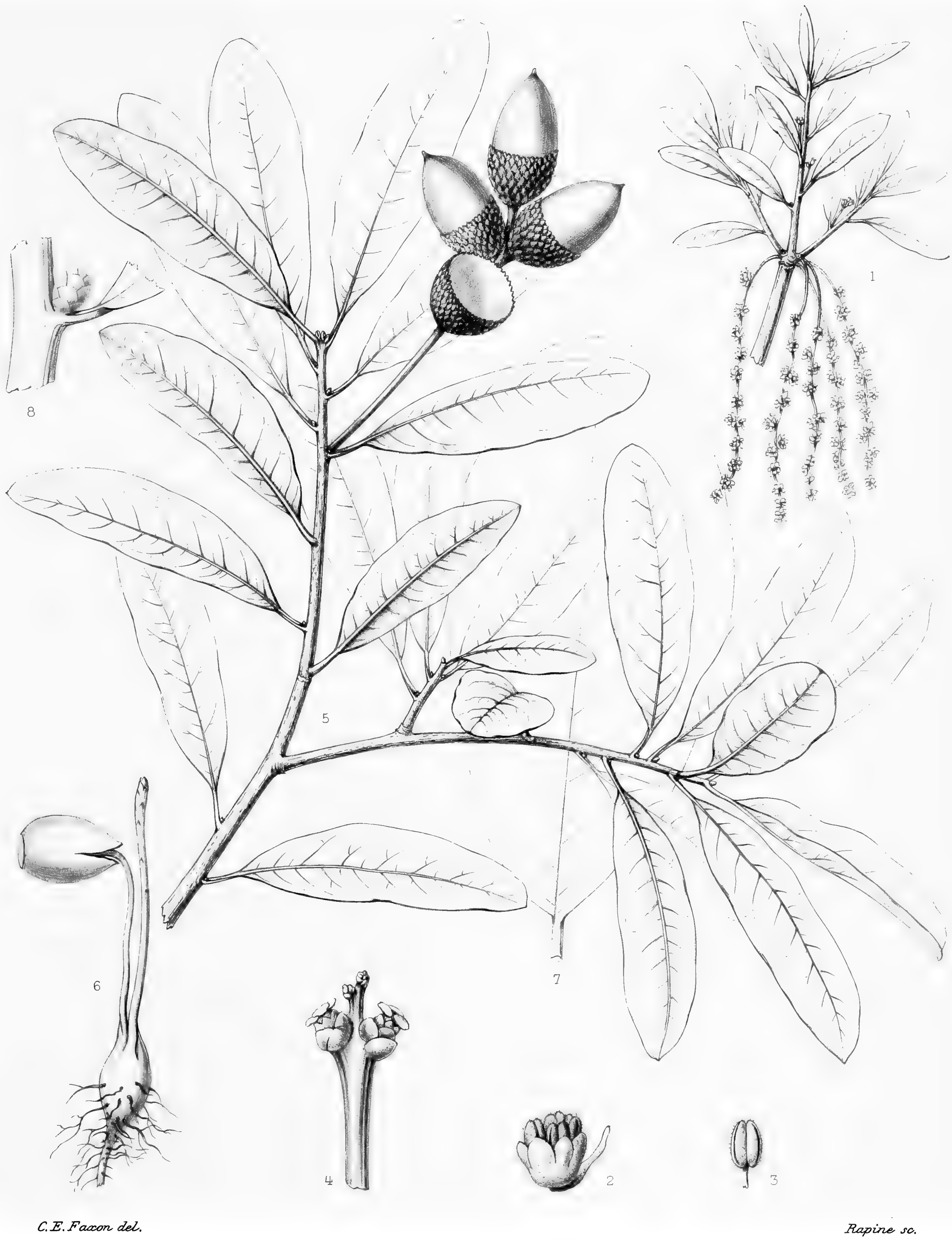
1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A stamen, enlarged.
4. A pistillate inflorescence, enlarged.
5. A fruiting branch, natural size.
6. A germinating nut, natural size.
7. A leaf, natural size.
8. A winter-bud, natural size.

Plate CCCXCV. Quercus Virginiana.

1. A fruiting branch, natural size.
2. A fruiting branch, natural size.
3. A fruiting branch, natural size.
4. End of a young shoot with small oblong lanceolate leaves.
5. A fruit, natural size.
6. A fruit, natural size.

Plate CCCXCVI. Quercus Virginiana, var. minima.

1. A fruiting plant, natural size.
2. Portion of a plant, showing the large obovate lower leaves and the small oblong-lanceolate upper leaves, natural size.
3. A leaf, natural size.
4. A leaf, natural size.
5. A peduncle and cups, natural size.



C.E. Faxon del.

Rapine sc.

QUERCUS VIRGINIANA, Mill.

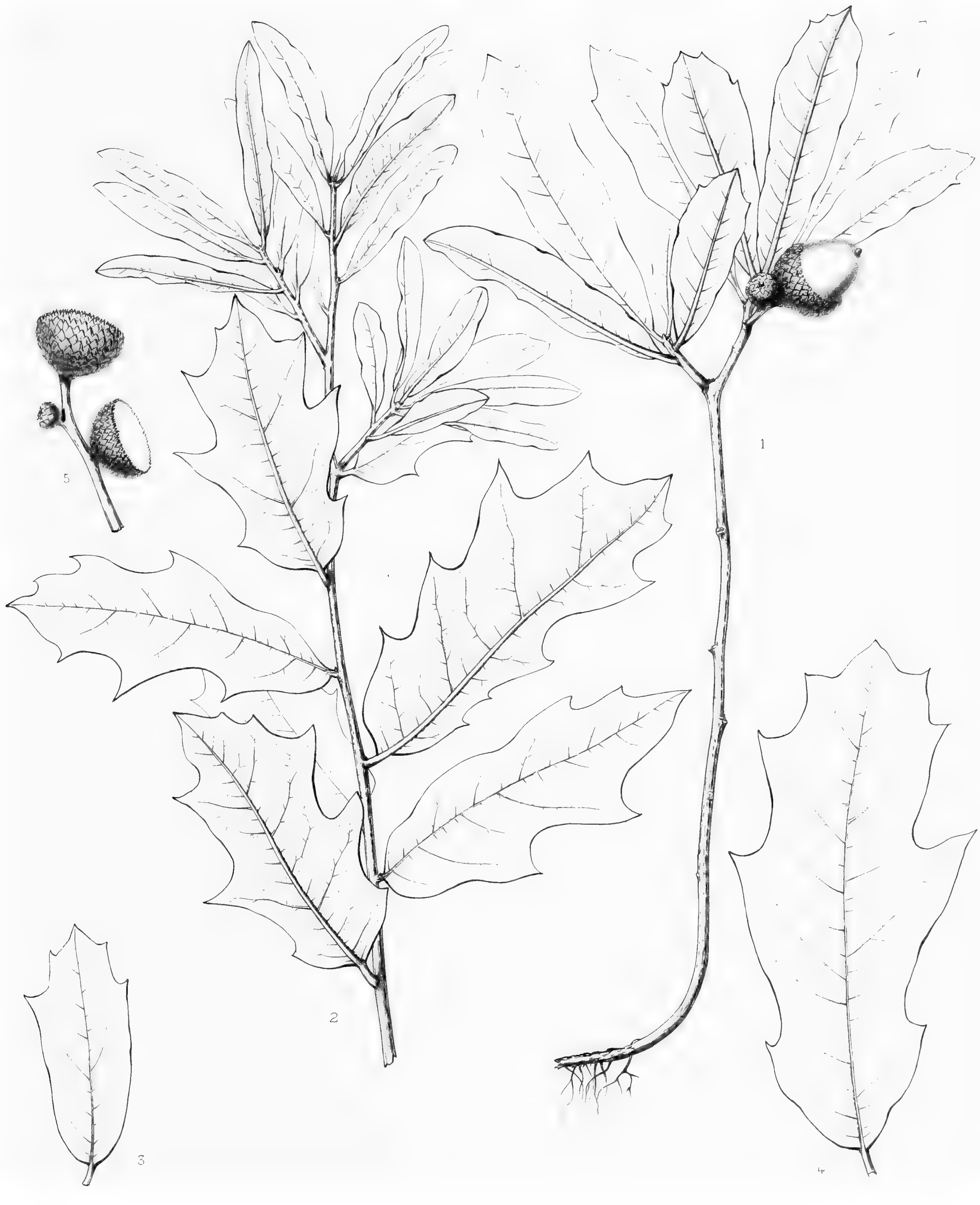
A. Riocreux direx.t

Imp. J. Taneur, Paris.

C.E. Faxon del. Toulet sc.

QUERCUS VIRGINIANA, Mill.

A. Riocreux direx.t Imp. J. Taneur, Paris.



C.E.Faxon del. Himely sc.

QUERCUS VIRGINIANA, var. MINIMA, Sarg

A. Riocreux direx.t Imp. J. Taneur, Paris.

QUERCUS EMORYI.

Black Oak.

LEAVES oblong-lanceolate, acute, entire or repand-serrate, coriaceous, dark green.

Quercus Emoryi, Torrey, *Emory's Rep.* 151, t. 9 (excl. f. 2) (1848); *Bot. Mex. Bound. Surv.* 206; *Pacific R. R. Rep.* iv. pt. i. 138; *Ives' Rep.* 28. — Engelmann, *Trans. St. Louis Acad.* iii. 382, 387, 394; *Rothrock Wheeler's Rep.* vi. 250. — Hemsley, *Bot. Biol. Am. Cent.* iii. 170 (excl. syn. *Quercus pungens*). — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 146. — Greene, *West Am. Oaks*, 45. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 416 (*Man. Pl. W. Texas*).

Quercus hastata, Liebmann, *Oversigt Dansk. Vidensk. Selsk. Forhandl.* 1854, 171. — A. de Candolle, *Prodr.* xvi. pt. ii. 36. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 69; *Liebmann Chênes Am. Trop.* 22. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 205.

A tree, usually thirty or forty feet in height, with a short trunk two or three feet in diameter and stout rigid rather drooping branches which form a round-topped symmetrical head; sometimes sixty or seventy feet high, with a trunk-diameter of four or five feet and a head occasionally one hundred feet across; and often at high elevations or on exposed mountain-slopes reduced to a low shrub.[1] The bark of the trunk is from one to two inches in thickness, very dark brown or nearly black, and deeply divided into large oblong thick plates separating on the surface into small thin closely appressed scales. The branchlets are slender, rigid, and marked with small pale lenticels, and when they first appear are coated with close hoary tomentum, which covers them during the summer; in their first winter they are rather bright red and pubescent or tomentose, and then gradually become glabrous and dark red-brown or black. The winter-buds are oval, acute, nearly a quarter of an inch long, and covered by closely imbricated thin light chestnut-brown scales, ciliate with pale hairs, and toward the point of the bud clothed with loose pale pubescence. The leaves are revolute in vernation, oblong-lanceolate, acute and mucronate at the apex, cordate or rarely rounded at the slightly narrowed base, and entire, or remotely repand-serrate with from one to five pairs of acute rigid oblique teeth; when they unfold they are thin, light green, more or less tinged with red and coated with silvery white tomentum, which is thickest on the lower surface and on the petioles; this rapidly disappears, with the exception of two large persistent tufts of white hairs, which usually remain on the under surface at the base of the midrib, and at maturity they are thick, rigid and coriaceous, dark green, very lustrous and glabrous or coated with minute stellate hairs above, and below pale and glabrous, or puberulous especially along the slender midribs, which are raised and rounded on the upper side, and the primary veins, which are often more prominent on the upper than on the lower surface of the leaf and are arcuate and united close to the thickened revolute margins; they are obscurely reticulate-venulose, and vary from one to two and a half inches in length and from half an inch to an inch in width, and, borne on stout slightly pubescent petioles, fall gradually in April with the unfolding of the flowers. The stipules are obovate-oblong or linear-lanceolate, brown and scarious, ciliate on the margins, from half an inch to an inch long, and caducous. The staminate flowers are produced in hoary-tomentose aments, from two to three inches in length; the calyx is light yellow, hairy on the outer surface, and divided into from five to seven ovate acute lobes; the stamens are composed of short slender filaments and large oblong, acute, or rounded yellow glabrous anthers. The pistillate flowers are sessile or borne on short peduncles, clothed, like the involucral scales, with hoary tomentum. The fruit, which matures during the first season, ripens irregularly from June until September, and is sessile or short-stalked; the nut is oblong, oval or ovate, narrowed at the base and rounded at the narrow pilose apex, from one half to three quarters

[1] Toumey, *Garden and Forest*, viii. 13.

of an inch long and about a third of an inch wide, light dull green when fully grown and dark chestnut-brown or nearly black when ripe, but soon becoming light red-brown in drying, with a thin brittle outer coat and an inner coat lined with thick white tomentum, abortive ovules which are sometimes basal and sometimes are scattered irregularly over the side of the seed, and sweet yellow cotyledons; the cup, which incloses from one third to nearly one half of the nut, is deeply cup-shaped or nearly hemispherical, light green and pubescent within, and covered with closely imbricated broadly ovate acute thin and scarious light brown scales clothed with short soft pale pubescence.

Quercus Emoryi grows on the mountain ranges of western Texas, on those of New Mexico and Arizona south of the Colorado plateau, and on those of Nuevo Leon, Chihuahua, and Sonora.[1] In Texas it is common in the cañons and on the southern slopes of the Limpio Mountains, and is the only tree in some of the cañons of the Chisos Mountains.[2] It is the most abundant Oak of southern New Mexico and Arizona, forming a large part of the open forests which clothe the mountain-slopes, and extending from the upper limits of the mesa, where it is mingled with *Quercus oblongifolia*, nearly to the highest ridges; often a shrub at these high elevations, it attains its greatest size and beauty in the moister soil of sheltered cañons.

The wood of *Quercus Emoryi* is very heavy, although not hard, strong, brittle, and close-grained; it is dark brown or almost black, with thick bright brown sapwood tinged with red, and contains bands of several rows of small open ducts marking the layers of annual growth and connected by narrow groups of similar ducts parallel to the broad conspicuous medullary rays. The specific gravity of the absolutely dry wood is 0.9263, a cubic foot weighing 57.73 pounds.

The sweet nuts, called by the Mexicans biotis, are an important article of food for Mexicans and Indians, and are sold in large quantities in the towns of southern Arizona and northern Mexico.

Quercus Emoryi was discovered on October 15, 1846, in the valley of Pigeon Creek in southern New Mexico, by Colonel W. H. Emory,[3] while in command of a military reconnaisance from Fort Leavenworth, in Missouri, to San Diego, California.

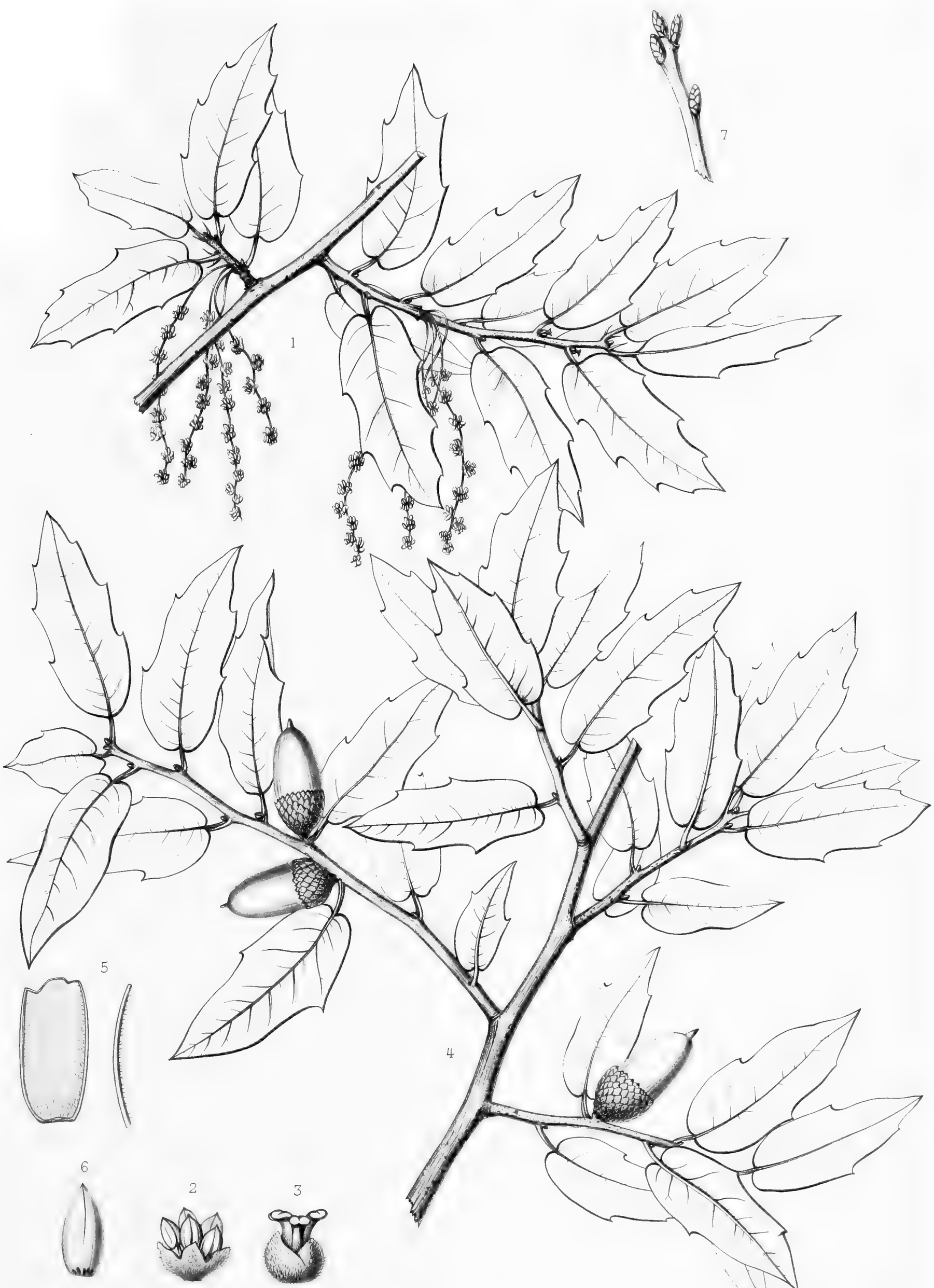
One of the most beautiful of North American Oaks in its symmetry of outline and in the rich color of its foliage, *Quercus Emoryi* forms with *Quercus Arizonica* the principal part of the open forests which clothe with perennial green the stony sun-baked lower slopes of the mountains of southern Arizona and New Mexico.

[1] Pringle, *Garden and Forest*, i. 142; iii. 338.
[2] Havard, *Proc. U. S. Nat. Mus.* viii. 505.
[3] See iv. 60.

EXPLANATION OF THE PLATE.

PLATE CCCXCVII. QUERCUS EMORYI.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. Sections of a pericarp showing the tomentum on the inner surface, enlarged.
6. A seed with basal, abortive ovules, natural size.
7. End of a branch, the leaves removed, showing winter-buds, natural size.



C.E.Faxon del.

Lövendal sc.

QUERCUS EMORYI, Torr.

A.Riocreux direxit

Imp. J. Taneur, Paris.

QUERCUS CHRYSOLEPIS.

Live Oak. Maul Oak.

LEAVES oblong, acute or cuspidate, entire, dentate or sinuate-toothed, fulvous-tomentose and ultimately pale below, persistent.

Quercus chrysolepis, Liebmann, *Oversigt Dansk. Vidensk. Selsk. Forhandl.* 1854, 173. — Bentham, *Pl. Hartweg.* 336. — Torrey, *Bot. Mex. Bound. Surv.* 207; *Bot. Wilkes Explor. Exped.* 459. — Kellogg, *Proc. Cal. Acad.* ii. 45; *Forest Trees of California*, 73. — A. de Candolle, *Prodr.* xvi. pt. ii. 37. — Bolander, *Proc. Cal. Acad.* iii. 231. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 69; *Liebmann Chênes Am. Trop.* 23, t. 47. — Engelmann, *Trans. St. Louis Acad.* iii. 383, 393; *Rothrock Wheeler's Rep.* vi. 374; *Brewer & Watson Bot. Cal.* ii. 97. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 204. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 146. — Greene, *West Am. Oaks*, 39, t. 21, 22; *Man. Bot. Bay Region*, 302. — Coville, *Contrib. U. S. Nat. Herb.* iv. 196 (*Bot. Death Valley Exped.*). — S. B. Parish, *Zoë*, iv. 346.

Quercus fulvescens, Kellogg, *Proc. Cal. Acad.* i. 67 (1855). — Newberry, *Pacific R. R. Rep.* vi. 27, f. 5; 89.

Quercus crassipocula, Torrey, *Pacific R. R. Rep.* iv. pt. i. 137 (1856); v. 365, t. 9.

This California Live Oak is usually not more than forty or fifty feet in height, with a short trunk from three to five feet in diameter dividing into great horizontal limbs, sometimes covering a space one hundred and fifty feet across, and often sweeping the ground with slender often pendulous branches; occasionally at low elevations in sheltered cañons it produces trunks eight or nine feet in diameter; on exposed mountain-sides it forms dense thickets fifteen or twenty feet high; and on high subalpine slopes it is a low prostrate shrub. The bark of the trunk varies from three quarters of an inch to an inch and a half in thickness, and is light or dark gray-brown slightly tinged with red, the generally smooth surface separating into small appressed scales. The branchlets are slender and rigid or flexible, and are marked with occasional elevated lenticels; when they first appear they are coated with thick fulvous tomentum, and during their first winter are dark brown somewhat tinged with red, and tomentose, pubescent or glabrous, ultimately becoming light brown or ashy gray. The winter-buds are broadly ovate or oval, acute, about an eighth of an inch long, and covered by closely imbricated light chestnut-brown and usually puberulous scales pale and scarious on the margins. The leaves are involute in the bud, oblong-ovate to elliptical, cordate, rounded or wedge-shaped at the base, acute or cuspidate at the apex, mostly entire on old trees and on young ones often dentate or sinuate-dentate, with one or two or many spinescent teeth, or on vigorous shoots the two forms frequently appear together; when they unfold they are clothed with a thick tomentum of fulvous articulated hairs which soon disappears from the upper and more gradually from the lower surface, and when fully grown they are thick and coriaceous, bright yellow-green and glabrous on the upper surface, and on the lower more or less fulvous-tomentose during the first year, ultimately becoming glabrate and bluish white; they are from one to four inches long and from half an inch to two inches wide, with slender yellow midribs slightly impressed above, obscure primary veins running to the teeth or forked near the thickened revolute margins, and slender inconspicuous reticulate veinlets; they are borne on slender yellow grooved petioles rarely half an inch in length, and do not fall until the third or fourth year. The stipules are oblong-obovate or linear-lanceolate, clothed with fulvous tomentum, hairy at the apex, from one half to three quarters of an inch long, and caducous. The flowers open in May and June, the staminate in the axils of linear-lanceolate acute bracts on slender tomentose aments from two to four inches in length, the pistillate sessile or subsessile or rarely borne in short few-flowered spikes. The calyx of the staminate flower is light yellow and pubescent, and is divided usually into from five to seven broadly

ovate acute lobes ciliate on the margins and often tinged with red above the middle. The stamens are composed of slender filaments and large oblong acute cuspidate glabrous yellow anthers. The broadly ovate involucral scales of the pistillate flower are coated with fulvous tomentum, and the stigmas are bright red. The fruit, which ripens in the autumn of its second year, is usually solitary, and is sessile or short-stalked; the nut is oval or ovate, acute or rounded at the full or narrow slightly puberulous apex, light chestnut-brown, from half an inch to nearly two inches long and about half as wide, with a thick shell covered on the inner surface, especially toward the apex, by a thin coat of loose pale tomentum, abortive ovules scattered irregularly over the side of the seed, and distinct or sometimes connate cotyledons; the cup is thin, hemispherical or turbinate, or thick and saucer-shaped, with a thick broad rim; it is pale green or dark reddish brown within, and covered by small triangular closely appressed scales which are clothed with hoary pubescence or are often hidden in a dense coat of fulvous tomentum, and are produced into short free tips.[1]

Quercus chrysolepis, although not rare, is not a gregarious tree, and often grows singly. It is distributed from Cow Creek Valley in southern Oregon along the California coast ranges and the western slopes of the Sierra Nevada, San Bernardino, San Jacinto, and Cuyamaca Mountains, and southward to Mt. San Pedro Martir in Lower California;[2] and as a low shrub or occasionally as a tree from twenty to thirty feet tall it grows on the high summits of the mountain ranges of southern Arizona and New Mexico and of northern Sonora. Generally a small tree in Oregon, or often a shrub producing small leaves and small fruit with thin deep cups clothed with pale tomentum, *Quercus chrysolepis* attains its greatest size with large leaves and large thick-cupped acorns on the steep rocky slopes of the cañons of the coast ranges of central California and on the foothills of the Sierra Nevada, which it ascends to from eight to nine thousand feet above the sea, gradually decreasing in size and producing smaller leaves and fruit;[3] at its highest elevations it is reduced to a shrub,[4] which sometimes extends over great areas in dense thickets of slender rigid or semiprostrate stems often only two or three feet tall, with entire or remotely dentate oblong or oval leaves acute or rounded at the base, acute or rounded at the apex, and rarely an inch in length, ovate or oval acute nuts sometimes not more than half an inch long, with purple separable cotyledons, and shallow cup-shaped or turbinate cups. Near the boundary between California and Lower California a form of this species, discovered by Dr. Edward Palmer[5]

[1] The cups of different individuals of this species vary more than those of any other North American Oak. In Oregon and often at high elevations in California they are clothed with hoary pubescence and produced into long light red tips; in the coast ranges and on the foothills of the Sierra Nevada they are more often flat, very thick, sometimes fully an inch across, with broad rims, and so covered with fulvous tomentum that the scales are indistinguishable; and on the mountains of New Mexico and Arizona, and on the Siskiyou and other high mountain ranges of northern California, they are small and deeply cup-shaped and are covered with red-brown slightly pubescent scales, much thickened on the back toward the base of the cup, and towards its rim produced into short free tips.

[2] Brandegee, *Zoë*, iv. 209.

[3] *Garden and Forest*, v. 121, f. 20.

[4] *Quercus chrysolepis*, subspec. *vacciniifolia*, Engelmann, *Trans. St. Louis Acad.* ii. 393 (1876); *Brewer & Watson Bot. Cal.* ii. 97. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 204. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 146.

Quercus vacciniifolia, Kellogg, *Proc. Cal. Acad.* i. 96 (1855). — Greene, *West Am. Oaks*, 45.

[5] Edward Palmer was born in Wilton, England, January 12, 1833. His father was a commercial florist, and he early acquired a love of flowers and a knowledge of their cultivation. He came to America in 1849 with a family of friends and settled in Cleveland, Ohio, where he was first occupied as attendant and nurse to Mr. J. W. Taylor, who had been Speaker of the House of Representatives in the Sixteenth Congress. His love of flowers could fortunately be gratified by several good gardens in the neighborhood of Cleveland, in which he passed all of his spare time. In 1853 he was appointed collector to an expedition sent by the government of the United States to Paraguay. Two years later he returned to Cleveland and obtained some instruction in medicine. In 1861, having previously resided in Colorado, he went to San Francisco, and, connecting himself with the Geological Survey of California, was stationed at San Diego. Anxious, however, to take some part in the Civil War, he returned to the East and secured the position of hospital steward in a Colorado regiment, serving in the west in this capacity until 1865, when he was appointed one of the contract surgeons of the army and stationed in Kansas, and in Arizona where he remained for several years, beginning at this time his real work as a collector. Since leaving the army Dr. Palmer has devoted himself to collecting plants and other natural objects, principally in the employ of the Smithsonian Institution and the Department of Agriculture of the United States. He has made large and important collections along the southern boundary of the United States from the shores of the Gulf of Mexico to those of the Pacific Ocean, and in many of the Mexican states.

In his long, laborious, and arduous career as a collector, Dr. Palmer has discovered many valuable and important plants. *Palmerella*, a genus of Californian herbs of the Mint family, was

in 1875, *Quercus chrysolepis*, var. *Palmeri*,[1] is less often a tree than a shrub, with stems usually fifteen or twenty feet tall, forming on low hills or on the plateau at the foot of the mountains large nearly impenetrable thickets. It has rigid branches, rigid coriaceous oblong or semiorbicular and mostly spinose-dentate leaves, pistillate flowers sometimes borne on long slender peduncles, subsessile or pedunculate fruit, with ovate acute nuts from an inch to an inch and a half long and from one third to two thirds of an inch wide, clothed on the inner surface of the shell with thick or thin pale tomentum, abortive ovules generally scattered on the side of the seed, and purple separable cotyledons.

More valuable as a timber-tree than the other Oaks of central California, *Quercus chrysolepis*[2] produces heavy very strong hard tough and close-grained wood; it is light brown, with thick rather darker colored sapwood, and contains many small open ducts arranged in wide bands parallel to the broad conspicuous medullary rays. The specific gravity of the absolutely dry wood is 0.8493, a cubic foot weighing 52.93 pounds. Although difficult to cut and work, it is used in the manufacture of agricultural implements and wagons.

Quercus chrysolepis was discovered by the German collector Karl Theodore Hartweg on the mountains near Monterey in 1846,[3] and was probably first noticed in New Mexico by Professor Edward L. Greene. The most beautiful of the California Oaks as it grows in the sheltered valleys of the coast ranges or on the foothills of the Sierra Nevada, *Quercus chrysolepis* is surpassed in majestic dignity and massive strength by no other American species except the Live Oak of the south Atlantic and Gulf states.

dedicated to him by Asa Gray, and his name, by its association with many species of plants, is inseparably connected with the botany of southwestern North America, which he has labored long and faithfully to make known.

[1] *Quercus chrysolepis*, subspec. *Palmeri*, Engelmann, *Trans. St. Louis Acad.* iii. 393 (1877).

Quercus Dunnii, Kellogg, *Pacific Rural Press*, June 7, 1879. — Mary K. Curran, *Bull. Cal. Acad.* i. 146 (1885). — Greene, *West Am. Oaks*, 46.

Quercus Palmeri, Engelmann, *Brewer & Watson Bot. Cal.* ii. 97 (1880). — Greene, *l. c.* pt. ii. 55, t. 25.

[2] In Kern County, California, *Quercus chrysolepis* is called the Hickory Oak.

[3] See *Jour. Hort. Soc. London*, ii. 124.

EXPLANATION OF THE PLATES.

PLATE CCCXCVIII. QUERCUS CHRYSOLEPIS.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A fruiting branch, natural size.
6. A fruit, natural size.
7. An axillary winter-bud, enlarged.

PLATE CCCXCIX. QUERCUS CHRYSOLEPIS.

1. A fruiting branch, natural size.
2. A sterile branch, natural size.
3. A fruiting branch, natural size.
4. A fruiting branch, natural size.
5. A fruit, natural size.
6. A fruit, natural size.
7. A fruit, natural size.
8. A winter-bud, natural size.

PLATE CCCC. QUERCUS CHRYSOLEPIS, var. VACCINIIFOLIA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A sterile branch, natural size.
5. A fruit, natural size.
6. A fruit, natural size.

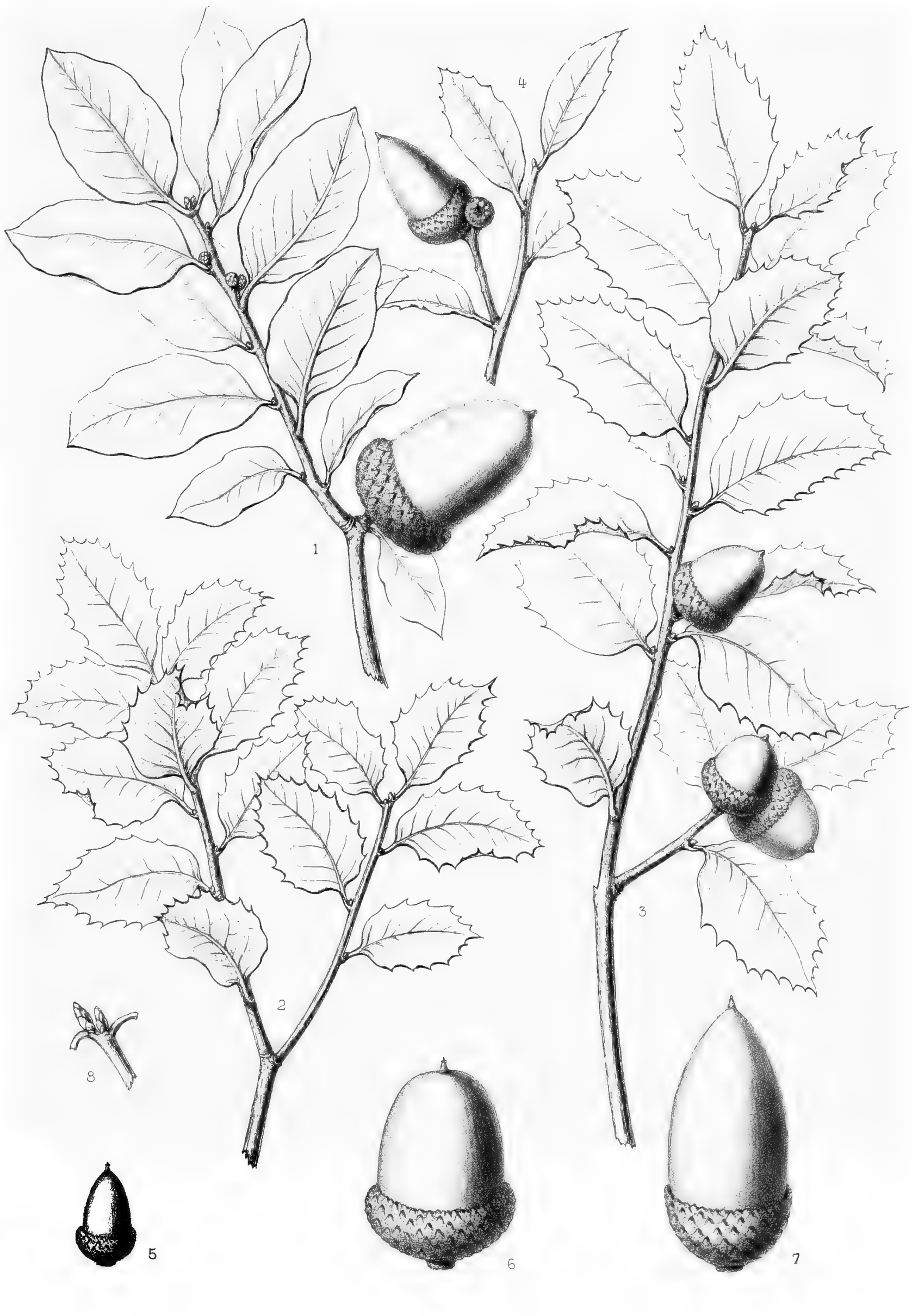
PLATE CCCCI. QUERCUS CHRYSOLEPIS, var. PALMERI.

1. A flowering branch, natural size.
2. A flowering branch, natural size.
3. A staminate flower, enlarged.
4. A pistillate flower, enlarged.
5. A fruiting branch, enlarged.
6. A fruit, natural size.
7. A fruit, natural size.
8. A fruit, natural size.

C.E.Faxon del. *Migneaux sc.*

QUERCUS CHRYSOLEPIS, Benth.

A.Riocreux direx.t *Imp. J.Taneur, Paris.*



C. E. Faxon del. *Rapine sc.*

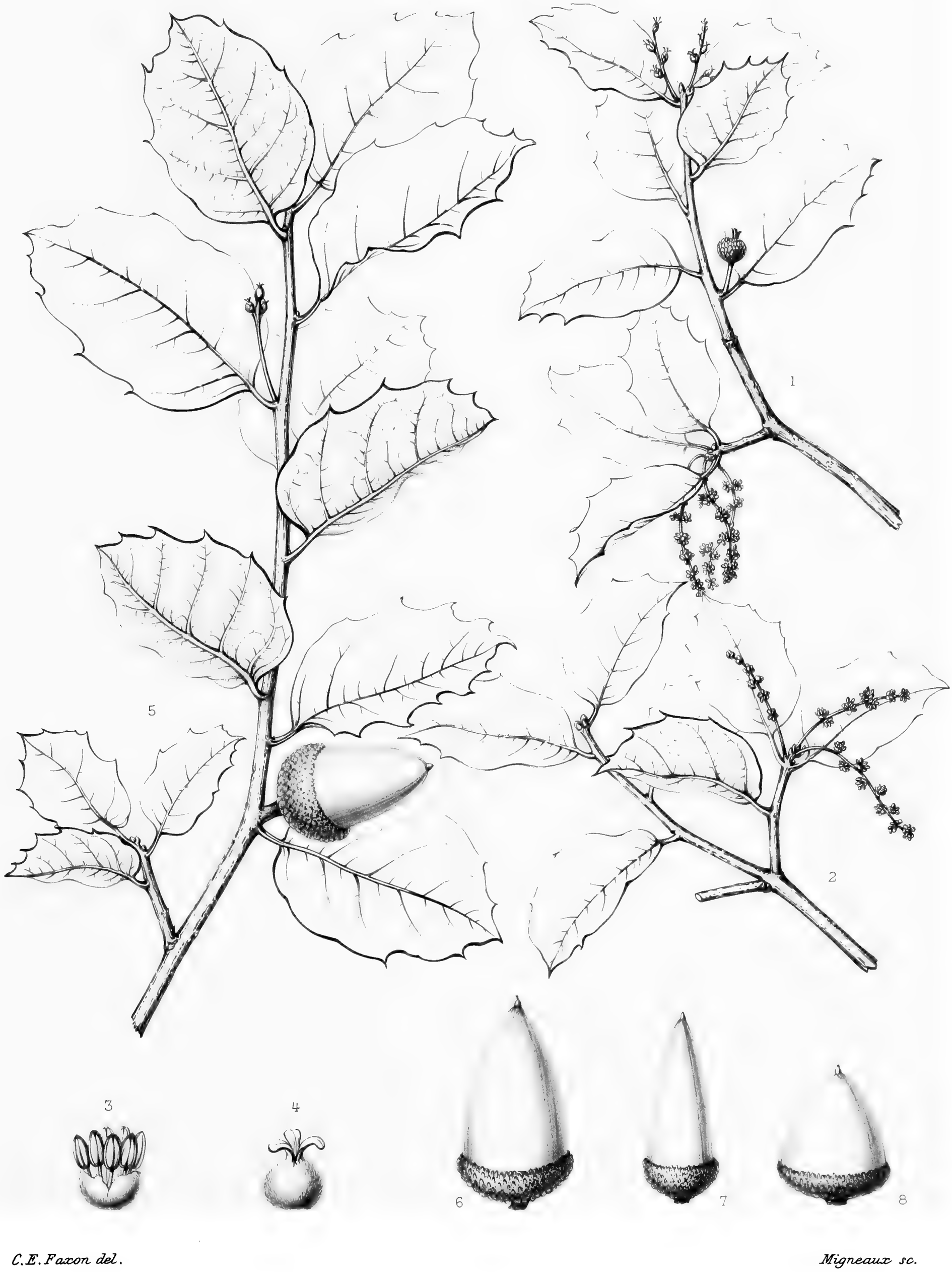
QUERCUS CHRYSOLEPIS, Benth.

A. Riocreux · direx.t *Imp. J. Taneur, Paris.*

C.E. Faxon del. Himely sc.

QUERCUS CHRYSOLEPIS, var. VACCINIIFOLIA, Engelm.

A. Riocreux direx.t Imp. J. Taneur, Paris.



C.E. Faxon del. *Migneaux sc.*

QUERCUS CHRYSOLEPIS, var. PALMERI, Engelm.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

QUERCUS TOMENTELLA.

LEAVES oblong-lanceolate, acute, crenate-dentate or entire, conspicuously veined, pubescent on the lower surface, persistent.

Quercus tomentella, Engelmann, *Trans. St. Louis Acad.* iii. 393 (1877); *Brewer & Watson Bot. Cal.* ii. 97. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 209. — Greene, *Bull. Cal. Acad.* i. 218; *West Am. Oaks*, 45, pt. ii. 57, t. 26. — Brandegee, *Proc. Cal. Acad.* ser. 2, i. 217. — Sargent, *Garden and Forest*, ii. 471. — Franceschi, *Zoë*, iv. 138.

Quercus chrysolepis, Watson, *Proc. Am. Acad.* xi. 119 (not Liebmann) (1876).

A tree, as now known, thirty or forty or occasionally sixty feet in height, with a trunk from one to two feet in diameter and a shapely round-topped head.[1] The bark of the trunk is thin, reddish brown, and broken into large closely appressed scales. The branchlets are slender and roughened with small elevated lenticels, and at first are coated with hoary tomentum which sometimes entirely disappears during the summer, or continues to cover vigorous shoots until their second year, when they are light brown tinged with red or orange-color. The winter-buds are ovate, acute or obtuse, nearly a quarter of an inch long, and covered by numerous loosely imbricated light chestnut-brown scales more or less clothed with pale pubescence. The leaves are involute in the bud, oblong-lanceolate, broad and rounded or gradually narrowed and abruptly wedge-shaped at the base, acute and sometimes cuspidate or occasionally rounded at the apex, and remotely crenate-dentate with small acute spreading or incurved callous-tipped teeth, or entire; when they unfold they are light green tinged with red, covered above with scattered pale stellate hairs, and below and on the petioles with dense hoary tomentum, and at maturity they are thick and coriaceous, dark green, glabrous and lustrous on the upper surface, and pale and covered with stellate hairs on the lower surface which, however, especially on vigorous shoots, is sometimes clothed with close pale pubescence sparingly mixed with articulate hairs; they are from two to four inches long and from one to two inches wide with thickened and strongly revolute margins, stout pubescent midribs, and numerous prominent primary veins which are often forked and which run to the points of the teeth or are arcuate and united within the entire margins and are connected by inconspicuous cross veinlets; borne on stout flattened pubescent petioles about half an inch in length, the leaves remain during at least two years on the branches. The stipules are oblong-obovate or linear-lanceolate, brown and scarious, covered with pale hairs, and caducous. The flowers appear in April; the staminate are borne in the axils of linear-lanceolate scarious bracts on pubescent aments which are from two and a half to fourteen inches in length and are produced from the axils of the scales of the terminal bud or from those of young leaves, and the pistillate are subsessile or in few-flowered spikes on short or elongated pubescent peduncles. The calyx of the staminate flower is light yellow, stellate-pubescent, and divided into from five to seven ovate acute lobes shorter than the nine or ten stamens composed of slender filaments and oblong acute cuspidate glabrous yellow anthers. The involucral scales and the calyx of the pistillate flower are coated with stellate hairs, and the stigmas are red. The fruit ripens at the end of the second season, and is subsessile or borne on a short stout

[1] It is probable that under favorable conditions this tree once grew to a much larger size. The only plants I have seen are in a sheltered cañon opening toward the sea on the eastern side of the island of Santa Catalina south of Avalon, where there is a small grove of stems about thirty feet high growing in a regular circle twelve feet in diameter and evidently shoots from the stump of a large tree, the remains of which can still be traced. Thirty years ago a company of United States soldiers was stationed on Santa Catalina, and a great deal of wood is said to have been cut at this time, when the tree whose stump produced these suckers was probably destroyed. Had this great tree been spared, it would have given a better idea of the species than can be obtained from the small and often stunted individuals scattered over the California islands, which preserve it from extinction.

peduncle; the nut is oval, broad at the base, full and rounded at the apex, and about an inch and a half long and three quarters of an inch wide, with a thick shell slightly scurfy-pubescent on the inner surface and purple separable cotyledons; the cup, which embraces only the base of the nut, is cup-shaped, shallow, thickened below and thin at the rim, light brown and pubescent on the inner surface, and covered by thin ovate acute scales, with free chestnut-brown tips more or less hidden by a thick coat of hoary tomentum.

Quercus tomentella inhabits deep narrow cañons and high wind-swept slopes on Santa Rosa and Santa Cruz Islands south of Santa Barbara and on Santa Catalina Island south of Cape St. Vincent in California, and on Guadaloupe Island off the coast of Lower California, where it was discovered by Dr. Edward Palmer in the spring of 1875.

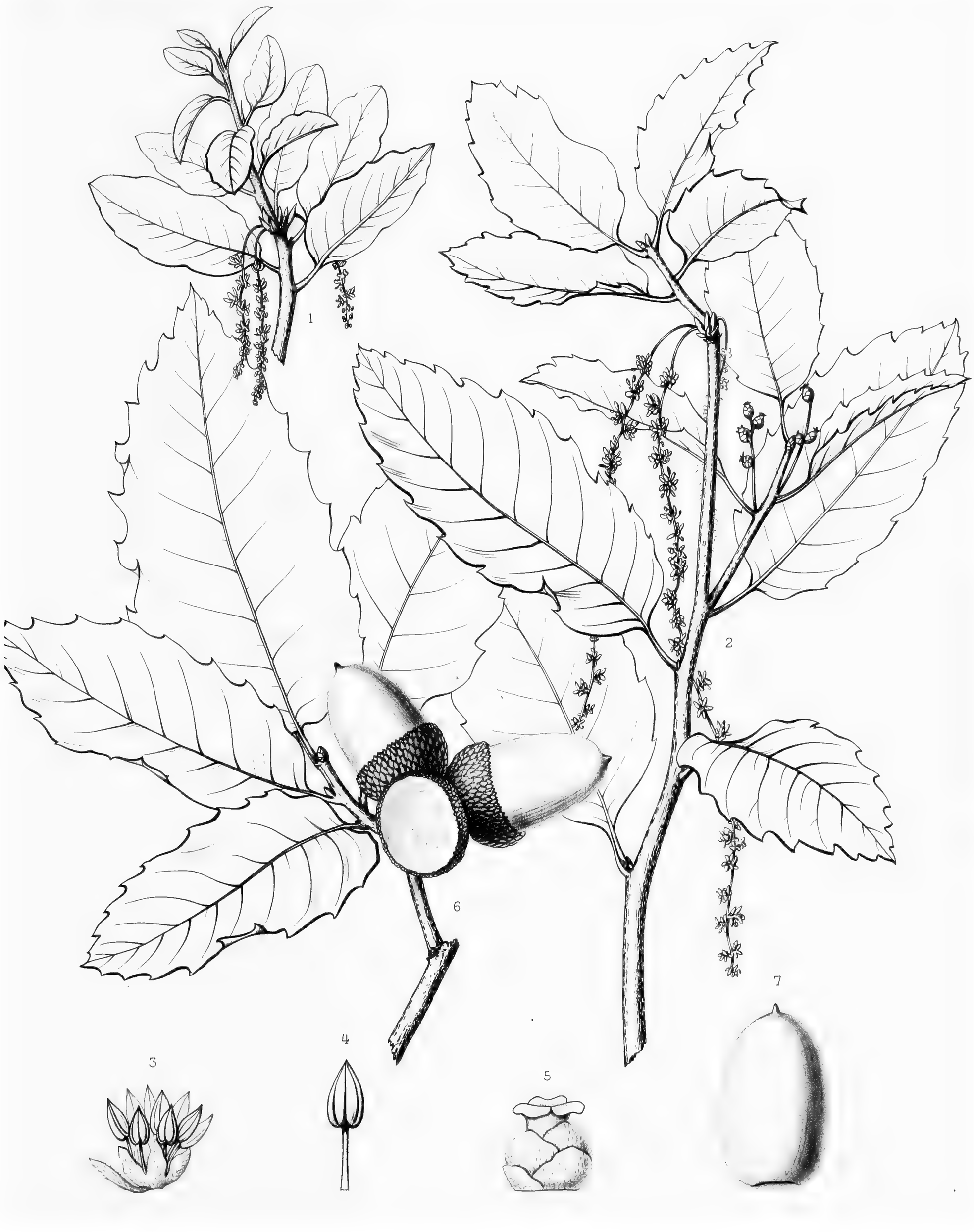
The wood of *Quercus tomentella* is heavy, hard, close-grained, and compact, with a satiny surface; it is pale yellow-brown, with lighter colored sapwood, and contains broad bands of open ducts parallel with the wide conspicuous medullary rays. The specific gravity of the absolutely dry wood is 0.7214, a cubic foot weighing 44.95 pounds.[1]

[1] Sargent, *Garden and Forest*, iii. 355.

EXPLANATION OF THE PLATE.

PLATE CCCCII. QUERCUS TOMENTELLA.

1. A flowering branch, natural size.
2. A flowering branch, natural size.
3. A staminate flower, enlarged.
4. A stamen, enlarged.
5. A pistillate flower, enlarged.
6. A fruiting branch, natural size.
7. A nut, natural size.



C. E. Faxon del. *Lövendal sc.*

QUERCUS TOMENTELLA, Engelm.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

QUERCUS AGRIFOLIA.

Live Oak. Encina.

LEAVES oval, orbicular, or oblong, entire or sinuately spinose-dentate, convex on the upper surface.

Quercus agrifolia, Née, *Ann. Cienc. Nat.* iii. 271 (*Descripcion de varias Especies nuevas de Encina*) (1801). — Willdenow, *Spec.* iv. pt. i. 431. — Persoon, *Syn.* ii. 568. — Pursh, *Fl. Am. Sept.* ii. 627. — Nuttall, *Gen.* ii. 214; *Sylva*, i. 5, t. 2. — *Nouveau Duhamel*, vii. 156. — Sprengel, *Syst.* iii. 859. — Loudon, *Arb. Brit.* iii. 894. — Bentham, *Pl. Hartweg.* 337; *Bot. Voy. Sulphur*, 55. — Hooker, *Icon.* iv. t. 377. — Hooker & Arnott, *Bot. Voy. Beechey*, 391. — Dietrich, *Syn.* v. 308. — Carrière, *Fl. des Serres*, vii. 137, f. — Torrey, *Sitgreaves' Rep.* 173; *Pacific R. R. Rep.* iv. pt. i. 138; v. 365; vii. 20; *Bot. Mex. Bound. Surv.* 206; *Ives' Rep.* 28; *Bot. Wilkes Explor. Exped.* 460. — Paxton, *Brit. Fl. Gard.* ii. 44. — Newberry, *Pacific R. R. Rep.* vi. 32, f. 9. — Bolander, *Proc. Cal. Acad.* iii. 229. — A. de Candolle, *Prodr.* xvi. pt. ii. 37. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 69; *Liebmann Chênes Am. Trop.* t. 44. — Engelmann, *Trans. St. Louis Acad.* iii. 383; *Rothrock Wheeler's Rep.* vi. 374; *Brewer & Watson Bot. Cal.* ii. 98. — Hemsley, *Bot. Biol. Am. Cent.* iii. 167. — Kellogg, *Forest Trees of California*, 78. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 203. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 146. — Greene, *West Am. Oaks*, 7, t. 5; *Man. Bot. Bay Region*, 303; *Pittonia*, ii. 114. — Dippel, *Handb. Laubholzk*, ii. 124, f. 61.

Quercus oxyadenia, Torrey, *Sitgreaves' Rep.* 172, t. 17 (1853).

Quercus berberidifolia, Liebmann, *Oversigt Dansk. Vidensk. Selsk. Forhandl.* 1854, 172. — Örsted, *Liebmann Chênes Am. Trop.* 22.

Quercus arcoglandis, Kellogg, *Proc. Cal. Acad.* i. 25 (1855).

Quercus agrifolia, var. **frutescens**, Engelmann, *Brewer & Watson Bot. Cal.* ii. 98 (1880). — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 203.

Quercus agrifolia, γ **berberifolia**, Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 203 (1885).

This is a low round-topped tree, occasionally eighty or ninety feet in height, with a short trunk three or four or rarely six or seven feet in diameter, dividing a few feet above its base into numerous great limbs which often rest on the ground and frequently cover an area one hundred or one hundred and fifty feet across; or sometimes the stem, rising to a height of thirty or forty feet, is crowned by a narrow head of smaller branches; or often it is much smaller, or shrubby in habit, with slender stems only a few feet high. The bark of the trunk is from two to three inches in thickness, dark brown slightly tinged with red, and divided into broad rounded ridges separating on the surface into small closely appressed scales; that of the young stems and the branches is much thinner, and is close, light brown or pale bluish gray. The branchlets are slender, dark gray or brown tinged with red, and coated at first with hoary tomentum which often does not entirely disappear until the second or third year. The winter-buds are globose and usually about a sixteenth of an inch in length, or ovate-oblong, acute, and sometimes on vigorous shoots nearly a quarter of an inch long, and are covered by thin broadly ovate closely imbricated light chestnut-brown glabrous or pubescent scales. The leaves are revolute in the bud, oval, orbicular or oblong, rounded or cordate at the base, rounded or acute and apiculate at the apex, and entire, or sinuate-dentate with slender rigid spinose teeth; when they unfold they are tinged with red and coated with caducous hoary tomentum which in disappearing sometimes leaves conspicuous clusters of white hairs in the axils of the primary veins on the lower surface of the half-grown leaves; and at maturity they are subcoriaceous, convex, dark or pale green, dull and obscurely reticulate on the upper surface, and on the lower surface paler, rather lustrous, glabrous or stellate-pubescent, and often furnished with tufts of rusty hairs in the axils of the principal veins; or, on occasional individual trees, they are covered above with pale stellate hairs and coated below with thick hoary pubescence; usually from two to two and a half inches long and about an inch and a half wide,

they vary from three quarters of an inch to four inches in length and from half an inch to three inches in width, with slender midribs and few primary veins often forking near the thickened strongly revolute margins and running to the points of the teeth, and obscure reticulate veinlets; borne on stout or slender pubescent or glabrous petioles from half an inch to nearly an inch in length, they fall gradually during the winter, disappearing entirely from some individuals before the appearance of the new growth in the spring, or on others persisting several weeks longer. The stipules are obovate-oblong or linear-lanceolate, brown and scarious, about half an inch long, and caducous. The flowers open early in the spring and sometimes, when insects[1] have injured the early foliage or abundant autumn rains have stimulated a second growth, again late in the season; the staminate are borne in slender hairy aments three or four inches long from the axils of bud-scales or from those of leaves of the year, and the pistillate are sessile or short-pedunculate. The calyx of the staminate flower, which in the bud is bright purple-red and sometimes furnished with a tuft of long pale hairs at the apex, is thin, scarious, glabrous or glabrate, and divided nearly to the base into from five to seven ovate acute segments reddish above the middle and shorter than the stamens, which vary from six to ten in number, and are composed of slender filaments and oblong emarginate glabrous yellow anthers. The involucral scales of the pistillate flower, like the stigmas, are bright red, and are coated with thick hoary tomentum or are sometimes glabrous or puberulous. Rarely the flowers are perfect and are produced in elongated spikes.[2] The fruit is sessile or subsessile, solitary or in few-fruited clusters, and ripens in the autumn; or the small fruit of autumnal flowers sometimes remains on the branches during the winter and increases in size in the spring, but falls before reaching maturity; the nut is elongated, ovate, abruptly narrowed at the base, gradually narrowed to the acute puberulous apex, light chestnut-brown, from three quarters of an inch to an inch and one half long and from one quarter to three quarters of an inch wide, with a thin shell lined with a thick coat of pale tomentum, abortive ovules at the apex of the seed, and yellow cotyledons; the cup, which embraces about a third or rarely only the base of the nut, is thin, turbinate, light brown and coated on the inner surface with soft pale silky pubescence, and is covered by thin papery scales rounded at the narrow apex and slightly puberulous, especially toward the base of the cup.

Quercus agrifolia, which usually forms open groves often of great extent, is distributed from Mendocino County, California, southward through the coast ranges and islands to Mt. San Pedro Martir in Lower California.[3] Less common at the north, it is very abundant and grows to its largest size in the valleys south of San Francisco Bay, and with low semiprostrate and contorted stems frequently covers the sand-dunes on the coast of the central part of the state. In southwestern California it is the largest and most generally distributed Oak-tree between the mountains and the sea, often covering low hills and ascending to an elevation of twenty-eight hundred feet above the level of the ocean in the cañons of the San Gorgonio Pass.[4]

The wood of *Quercus agrifolia* is heavy, hard, and close-grained, but very brittle; it is light brown or reddish brown, with thick darker colored sapwood, and contains many large open ducts arranged in several rows parallel with the broad conspicuous medullary rays, the layers of annual growth being hardly distinguishable. The specific gravity of the absolutely dry wood is 0.8253, a cubic foot weighing 51.43 pounds. Valued and largely used for fuel, it is little esteemed for other purposes. The nuts are an important article of food to the Indians of Lower California.[5]

The first authentic reference to *Quercus agrifolia* was published in 1798 in the narrative of the

[1] In the neighborhood of the Bay of San Francisco, trees of this species are often stunted by the annual destruction of the foliage by *Phryganidia Californica*, Packard (*Fifth Rep. U. S. Entomolog. Comm.* 122. — Rivers, *The Oaks of Berkeley and Some of their Insect Inhabitants*, 1).

[2] In 1885 Professor Edward L. Greene (*West Am. Oaks*, 8) found a tree on the island of Santa Cruz with perfect spicate flowers on erect rigid peduncles (Plate cccciv. f. 4).

[3] Brandegee, *Zoë*, iv. 209.

[4] S. B. Parish, *Zoë*, iv. 346.

[5] The nuts of *Quercus agrifolia* are considered by the Indians of Lower California superior to those of all other acorns. After taking off the shells they grind the seeds into flour, which is thoroughly washed to remove its astringency, and then boiled with water into mush or rolled into balls and baked in the ashes (Palmer, *Am. Nat.* xii. 596).

voyage of Vancouver, who arrived in the Bay of San Francisco in November, 1792, and obtained a supply of the wood of this tree for fuel,[1] and the following year, being at Santa Barbara on the California coast, had some of the trees cut to repair one of his ships.[2]

The valleys and low hills of the California coast owe their greatest charm to this Oak-tree, which, dotting their covering of vernal green or their brown summer surface with its low broad heads of pale contorted branches and dense dark foliage, gives them the appearance of incomparably beautiful parks.

Introduced into the gardens of England in 1849[3] by Karl Theodore Hartweg, it is occasionally cultivated in the temperate countries of western and southern Europe.

[1] "A tent was immediately pitched on the shore, wells were dug for obtaining water, and a party was employed in procuring fuel from small bushy holly-leaved oaks, the only trees fit for our purpose." (ii. 5.)

[2] "We here procured some stout knees from the holly-leaved oak, for the security of the Discovery's head and bumkins; this, and other occupations fully engaged our time until the evening of the 17th, when preparations were made for sailing on the day following." (ii. 454.)

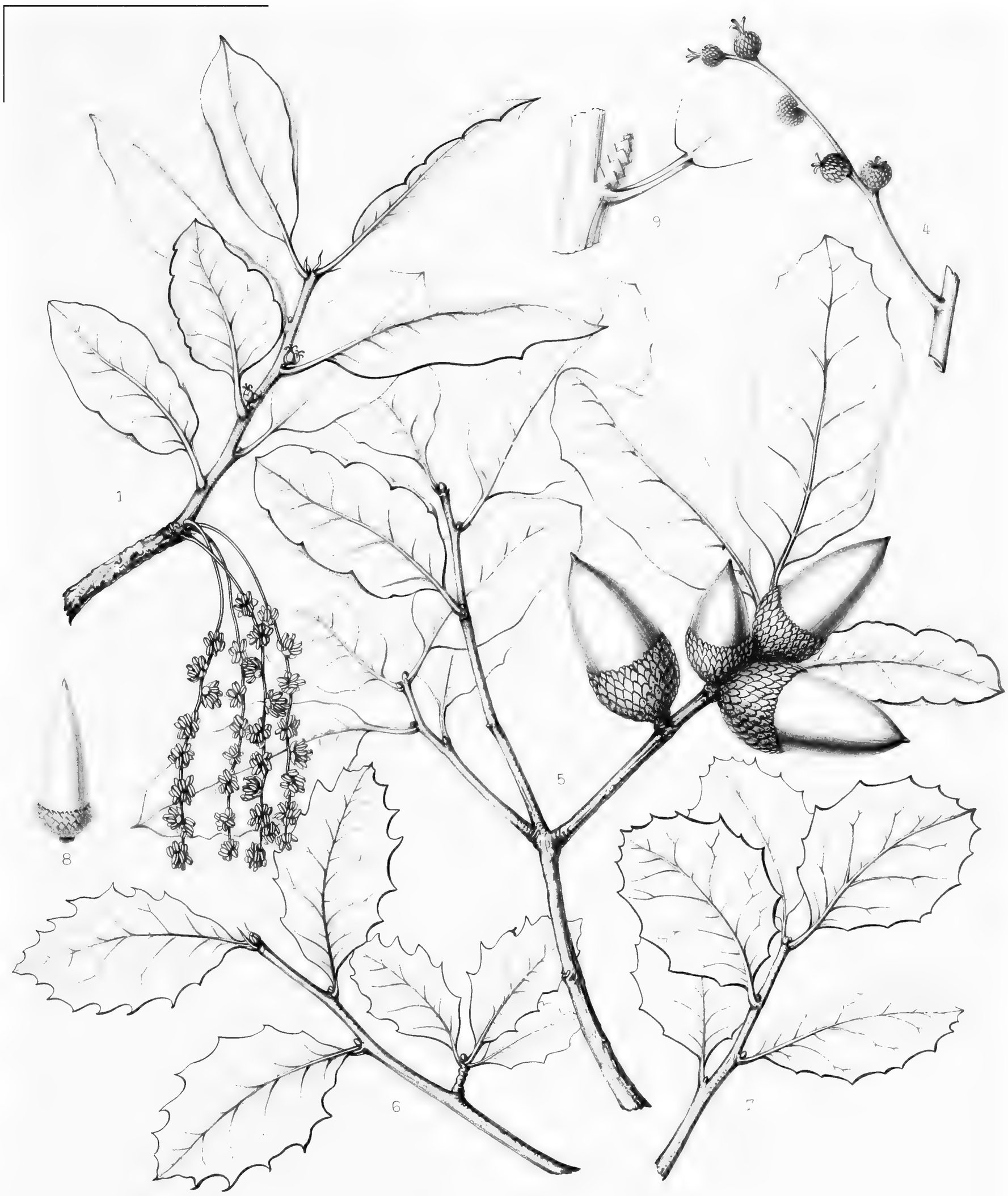
Professor Edward L. Greene has suggested (*Erythea*, ii. 46) that the Evergreen Oak seen by Fathers Kino and Juan de Torquemada between the Colorado River and the coast of California, and mentioned by Venegaz in the *Noticia de la California y de su Conquista* (i. 54), published in 1758, was this species, but they may as well have seen *Quercus Engelmanni*, *Quercus Wislizeni*, or some other Evergreen Oak of Lower California, as *Quercus agrifolia*.

[3] *Jour. Hort. Soc. London*, vi. 157, t.

EXPLANATION OF THE PLATE.

PLATE CCCCIII. QUERCUS AGRIFOLIA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A spike of perfect flowers, natural size.
5. A fruiting branch, natural size.
6. End of a sterile branch, natural size.
7. End of a sterile branch, natural size.
8. A fruit, natural size.
9. An axillary winter-bud, enlarged.



C.E.Faxon del. *Migneaux sc.*

QUERCUS AGRIFOLIA, Née.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

QUERCUS PUMILA.

Running Oak.

LEAVES oblong or elliptical, lanceolate or oblong-obovate, usually entire, glabrous or coated with pale pubescence on the lower surface.

Quercus pumila, Walter, *Fl. Car.* 234 (1788). — Michaux f. *Hist. Arb. Am.* ii. 84, t. 15. — Persoon, *Syn.* ii. 567. — Nuttall, *Gen.* ii. 214. — Elliott, *Sk.* ii. 594. — Engelmann, *Trans. St. Louis Acad.* iii. 384.

Quercus Phellos (pumila), Michaux, *Hist. Chênes Am.* No. 7, t. 13, f. 1 (1801). — Spach, *Hist. Vég.* xi. 161. — Dippel, *Handb. Laubholzk.* ii. 107. — Koehne, *Deutsche Dendr.* 131.

Quercus sericea, Willdenow, *Spec.* iv. pt. i. 424 (excl. syn. Aiton) (1805). — Poiret, *Lam. Dict.* Suppl. ii. 212 (excl. syn. Aiton). — *Nouveau Duhamel*, vii. 150. — Sprengel, *Syst.* iii. 858. — Dietrich, *Syn.* v. 307 (excl. habitat).

Quercus cinerea, var. **pumila**, Curtis. *Rep. Geolog. Surv. N. Car.* 1860, iii. 37. — Chapman, *Fl.* 421. — A. de Candolle, *Prodr.* xvi. pt. ii. 74.

Quercus Phellos, ϵ **nana**, A. de Candolle, *Prodr.* xvi. pt. ii. 74 (1864).

Quercus pumila, var. **sericea**, Engelmann, *Trans. St. Louis Acad.* iii. 384 (1876).

A shrub, spreading by underground stolons into broad thickets sometimes several acres in extent and occasionally rising to the height of ten or twelve feet, with many slender intricately branched stems one or two inches in diameter; usually smaller and often producing flowers and fruit when only a few inches high. The slender rigid branchlets are coated at first with hoary tomentum or are covered with scattered caducous stellate hairs, but soon become glabrous and during their first winter are bright or dark reddish brown or ashy gray. The winter-buds are acute, from a sixteenth to an eighth of an inch in length, and covered by numerous thin bright chestnut-brown closely imbricated scales. The leaves are revolute in the bud, oblong, elliptical, lanceolate, or obovate-oblong, wedge-shaped or rounded at the narrow base, and acute or rarely rounded and apiculate at the apex; or on vigorous young shoots they are sometimes ovate or oblong and deeply and very irregularly lobed with acute spreading apiculate lobes, or are sometimes broadly obovate and entire or slightly sinuate-dentate toward the rounded apex; when they unfold they are coated with hoary tomentum which is thickest on the lower surface or with scattered stellate hairs, and at maturity they are thick and firm, dark green and rather lustrous above, yellow-green and glabrous or coated with pale lustrous pubescence below, from one to four inches long and from one half to three quarters of an inch wide, with stout yellow midribs slightly rounded on the upper side, obscure primary veins arcuate and united near the margins, and fine reticulate veinlets; they are borne on stout yellow grooved petioles rarely a quarter of an inch in length and fall gradually in the spring with or after the appearance of the new growth. The stipules are obovate-oblong, brown and scarious, from one half to three quarters of an inch long, and caducous. The flowers appear in April with the first unfolding of the leaves, the staminate borne in villous aments two or three inches in length, the pistillate sessile or raised on short peduncles. The calyx of the staminate flower is light yellow, thin and scarious, and divided into broadly ovate slightly ciliate segments shorter than the stamens, which are usually four in number, with slender filaments and ovate emarginate glabrous yellow anthers. The involucral scales of the pistillate flower are coated, like its peduncles, with hoary tomentum, and the styles are long and recurved. The fruit, which ripens in the autumn of the first season, is sessile or subsessile and usually solitary; the nut is subglobose, generally rather longer than broad, full and rounded at the apex, which is covered with pale pubescence, about half an inch long and dark chestnut-brown, lustrous, and sometimes striate at maturity, but becoming light brown in drying, with a thick shell lined with pale tomentum and bright orange-colored cotyledons; the cup is

thin, saucer-shaped or more or less deeply cup-shaped, light brown and puberulous within, and covered by thin ovate-oblong closely appressed red-brown scales truncate or rounded at the apex and glabrous or coated with soft pale silky pubescence.[1]

Quercus pumila inhabits sandy barren soil in the immediate neighborhood of the coast from North Carolina to northeastern and western Florida.

Stunted by fires which every spring sweep over the region that it inhabits, destroying the growth of the previous year, the Running Oak is usually dependent on an annual growth for its existence, and is able only under exceptionally favorable conditions of location to grow to its full size.

[1] Two forms of this shrub, distinct in appearance but so connected by intermediate forms that they must be considered merely varieties of one species, grow together at Bluffton, South Carolina, in the same thickets and intermingled in such a way that it is difficult to decide that they have not sprung from the same root. On the first (*Quercus pumila* of Walter and Engelmann, Plate cccciv. f. 5, 7) the young branches and leaves are stellate-pubescent but soon become glabrous, and the cups of the acorns, which mature two or three weeks later than that of the other form, are saucer-shaped, broad and flat, and covered by closely appressed glabrous light brown scales dark red-brown above the middle. On the second form (*Quercus sericea*, Willdenow, Plate cccciv. f. 4, 6) the young branchlets and leaves are coated with hoary tomentum, the lower surface of the mature leaves is clothed with silky pubescence, and the cups of the acorns, which vary from saucer-shaped to deeply cup-shaped and sometimes inclose two thirds of the nut, are covered by more loosely imbricated scales clothed with pale silky pubescence.

EXPLANATION OF THE PLATE.

Plate CCCCIV. Quercus pumila.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A fruiting branch, natural size.
6. A fruit, natural size.
7. A fruit, natural size.
8. A leaf from the base of a vigorous shoot, natural size.
9. A leaf of a vigorous shoot, natural size.
10. A leaf of a vigorous shoot, natural size.

C.E.Faxon del. *Rapine sc.*

QUERCUS PUMILA, Walt.

A.Riocreux direx.t *Imp. J. Taneur, Paris.*

QUERCUS HYPOLEUCA.

LEAVES lanceolate or oblong-lanceolate or elliptical, entire, or spinose-dentate above the middle, coated below with pale or fulvous tomentum.

Quercus hypoleuca, Engelmann, *Trans. St. Louis Acad.* iii. 384 (1876); *Rothrock Wheeler's Rep.* vi. 251. — Rusby, *Bull. Torrey Bot. Club*, ix. 78. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 154. — Greene, *West Am. Oaks*, 9, t. 6.

Quercus confertifolia, Torrey, *Bot. Mex. Bound. Surv.* 207 (not Humboldt, Bonpland & Kunth) (1858).

Quercus Mexicana, γ **confertifolia**, Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 209 (in part) (1883).

A tree, usually from twenty to thirty or, sometimes, sixty feet in height, with a tall trunk from ten to fifteen inches in diameter, and slender branches which spread into a narrow round-topped inversely conical head; or frequently reduced to a shrub. The bark of the trunk is from three quarters of an inch to an inch in thickness, nearly black, and deeply divided into broad ridges broken on the surface into thick plate-like scales. The branchlets are stout, rigid, covered with minute pale lenticels and coated at first with thick hoary tomentum which gradually disappears during their first winter, when they become tomentose or glabrous, light red-brown and are often covered with a glaucous bloom, growing darker during their second year and ultimately nearly black. The winter-buds are ovate, obtuse, about an eighth of an inch long, and covered by thin light chestnut-brown scales with pale scarious margins. The leaves are revolute in the bud, lanceolate, oblong-lanceolate or elliptical, occasionally somewhat falcate, wedge-shaped or rounded or cordate at the narrow base, acute and often apiculate at the apex, and entire or repandly serrate above the middle with a few small minute rigid spinose teeth, or on vigorous shoots they are serrate-lobed with oblique acute lobes; when they unfold they are light red, covered with close pale deciduous pubescence above and coated below with thick hoary tomentum, and at maturity are thick and firm, dark yellow-green and lustrous on the upper surface, clothed on the lower with thick silvery white or fulvous tomentum, from two to four inches long and from half an inch to an inch wide, with slender midribs raised and rounded on the upper side, numerous stout primary veins forked near the much thickened and revolute margins, and fine closely reticulate veinlets; they are borne on stout flattened yellow pubescent or tomentose petioles abruptly enlarged toward the base and varying from an eighth to nearly a quarter of an inch in length, and turn yellow or brown and fall gradually during the spring after the appearance of the new growth. The flowers appear in April, the sterile borne on slender aments coated with loose pale tomentum and four or five inches in length, and the pistillate mostly solitary, and sessile or raised on short tomentose peduncles. The calyx of the staminate flower is thin and scarious, slightly tinged with red, covered on the outer surface with pale hairs, and deeply divided into four or five broadly ovate rounded lobes shorter than the four stamens with slender filaments and ovate acute apiculate glabrous anthers which are bright red as the flower opens and gradually turn yellow. The involucral scales and the calyx-lobes of the pistillate flower are thin and scarious and coated with soft pubescence, and the stigmas are recurved and dark red. The fruit, which ripens irregularly during the second summer,[1] is sessile or borne on a stout peduncle sometimes nearly half an inch long, and is usually solitary; the nut is ovate, acute or rounded at the narrow apex, which is covered with hoary pubescence, dark green and often striate when ripe, but becoming light chestnut-brown in drying, and from one half to two thirds of an inch long, with a thick shell lined with white tomentum; the cup, which incloses about a third of the nut, is turbinate, rather thick, pale

[1] The fruit of *Quercus hypoleuca* has been described as maturing at the end of the first season, but in the specimens I have seen the maturation is biennial, the fruit beginning to ripen in June and July.

and pubescent on the inner surface, and covered by thin broadly ovate light chestnut-brown scales rounded at the apex and clothed, especially toward the base of the cup, with soft silvery pubescence.

Quercus hypoleuca is distributed from the Limpio Mountains in western Texas over the mountain ranges of New Mexico and Arizona south of the Colorado plateau, and on those of northern Chihuahua and Sonora. Nowhere very abundant, it is scattered through the Pine forests on the slopes of cañons and high ridges usually between six and seven thousand feet above the level of the sea, but sometimes in shrubby forms descending a thousand feet lower.

The wood of *Quercus hypoleuca* is heavy, very strong, hard, and close-grained; it is dark brown, with thick lighter colored sapwood, and contains broad conspicuous medullary rays, the layers of annual growth being marked by narrow bands of small open ducts. The specific gravity of the absolutely dry wood is 0.8009, a cubic foot weighing 49.91 pounds.

This tree, one of the most distinct and beautiful of the small Oaks of North America, was discovered on the mountains of southern New Mexico by Charles Wright,[1] one of the botanists of the United States and Mexican Boundary Survey, in 1851.

[1] See i. 94.

EXPLANATION OF THE PLATE.

PLATE CCCCV. QUERCUS HYPOLEUCA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. End of a vigorous shoot, natural size.
6. A leaf, natural size.

C. E. Faxon del. Lebrun sc.

QUERCUS HYPOLEUCA, Engelm.

A. Riocreux direx.t Imp. J. Taneur, Paris.

QUERCUS WISLIZENI.

Live Oak.

LEAVES usually oblong-lanceolate, entire, serrate or sinuate-dentate, dark green and lustrous.

Quercus Wislizeni, A. de Candolle, *Prodr.* xvi. pt. ii. 67 (excl. habitat) (1864). — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 73. — Engelmann, *Trans. St. Louis Acad.* iii. 396; *Brewer & Watson Bot. Cal.* ii. 98. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 219. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 147. — Kellogg, *Forest Trees of California*, 134. — Greene, *West Am. Oaks*, 5, t. 3, 4; *Man. Bot. Bay Region*, 303. — Mayr, *Wald. Nordam.* 262, t. 2, 3. — Merriam, *North American Fauna*, No. 7, 334 (*Death Valley Exped.* ii.). — Coville, *Contrib. U. S. Nat. Herb.* iv. 197 (*Bot. Death Valley Exped.*).

Quercus Wislizeni, var. **frutescens**, Engelmann, *Trans. St. Louis Acad.* iii. 396 (1876); *Brewer & Watson Bot. Cal.* ii. 98. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 219. — S. B. Parish, *Zoë*, iv. 346.

Quercus parvula, Greene, *Pittonia*, i. 40 (1887).

A tree, occasionally seventy or eighty feet in height, with a short trunk from four to six feet in diameter and stout spreading branches which form a round-topped head; usually much smaller and sometimes reduced to an intricately branched shrub with numerous stems only a few feet tall. The bark on old trunks is from two to three inches thick, and is divided into broad rounded often connected ridges separating on the surface into small thick closely appressed dark brown scales slightly tinged with red; on younger trunks and on large branches it is much thinner, generally smooth and rather lighter colored. The branchlets are slender, rigid, and marked with minute pale scattered lenticels, and when they first appear are coated with hoary tomentum or covered with loose scattered stellate pubescence; during their first season they are puberulous or glabrous and rather light red-brown or gray-brown slightly tinged with red, and in their second year begin to grow darker. The winter-buds are ovate or oval, acute, from an eighth to nearly a quarter of an inch long, and covered by closely imbricated light chestnut-brown scales ciliate on the margins with occasional soft white hairs, especially on those near the apex of the bud. The leaves are revolute in vernation, mostly oblong-lanceolate but varying from narrowly lanceolate to broadly oval, rounded or truncate or gradually narrowed and wedge-shaped at the base, acute or rounded and generally apiculate at the apex, and entire, serrulate or serrate, or sinuate-dentate with spreading rigid spinescent teeth; when they unfold they are thin, dark red, ciliate on the margins, and covered with pale scattered caducous stellate hairs, and when fully grown they are thick and coriaceous, glabrous and lustrous, dark green on the upper and paler and yellow-green on the lower surface, usually an inch or an inch and a half long and about two thirds of an inch wide, but varying from half an inch to five inches in length and from one third of an inch to an inch and a half in width, with narrow yellow midribs rounded and raised on the upper side, obscure primary veins arcuate and united near the thickened slightly revolute margins, and conspicuous reticulate veinlets; they are borne on slender nearly terete petioles coated at first with hoary tomentum and usually pubescent or puberulous at maturity, and from an eighth of an inch to nearly an inch in length, and fall gradually during their second summer and autumn. The stipules are obovate-lanceolate or linear-lanceolate, brown and scarious, ciliate with pale hairs, nearly an inch long, and caducous. The flowers appear in early spring with the unfolding of the leaves, the staminate borne in hairy aments three or four inches in length, the pistillate being sessile or short-stalked. The calyx of the staminate flower is tinged with red in the bud, and is deeply divided into broadly ovate ciliate glabrous light yellow lobes shorter than the stamens, which vary in number from three to six and are composed of slender filaments and oblong slightly apiculate glabrous yellow anthers. The involucral scales of the pistillate flower and

its peduncle are clothed with hoary tomentum, and the styles, often more than three in number, are slender and recurved. The fruit, which ripens in the autumn of the second season, is sessile, short-pedunculate or occasionally spicate; the nut is slender, oblong-oval, abruptly narrowed at the base, gradually narrowed to the pointed pilose apex, from three quarters of an inch to an inch and a half long, about a third of an inch wide, and light chestnut-brown and often striate, with a thin hard shell lined with a scanty coat of pale tomentum; the cup is thin, turbinate, sometimes tubular, and from half an inch to an inch deep, or rarely cup-shaped and shallow, light green and puberulous within, and covered by oblong-lanceolate light brown closely imbricated scales which are thin or sometimes toward the base of the cup are thickened and rounded on the back, and are usually pubescent or puberulous, especially above the middle, and frequently ciliate on the margins.

Quercus Wislizeni is a distinct and handsome tree, and is distributed from the lower slopes of Mt. Shasta southward through the coast region of California to the Santa Lucia Mountains and to Santa Rosa and Santa Cruz Islands, and along the foothills and lower slopes of the Sierra Nevada as far south as the Tejon Pass; in shrubby forms it grows in cañons on the desert slopes of the San Bernardino, San Jacinto,[1] and Cuyamaca Mountains, and finds its most southern home on Mt. San Pedro Martir in Lower California.[2] Although nowhere very common, *Quercus Wislizeni* is most abundant and grows to its largest size in some of the valleys of the coast region of central California at some distance from the sea and on the foothills of the Sierra Nevada; with *Quercus dumosa* it is the common Oak in the cañons of the desert slopes of the mountains of southern California. Near the coast and on the islands it is small and often shrubby.

Individual trees[3] first noticed by Dr. Albert Kellogg[4] in Lake County, California, are believed to be hybrids between this species and the deciduous-leaved *Quercus Californica.*

[1] In Snow Creek Cañon, opening into the desert at the northern base of Mt. San Jacinto, are many small bushy trees of *Quercus Wislizeni*, bearing fruit with shallow cup-shaped cups (Plate ccccvi. f. 6), a form that I have not elsewhere seen.

[2] Brandegee, *Zoë*, iv. 209.

[3] *Quercus Wislizeni* × *Californica.*

Quercus Morehus, Kellogg, *Proc. Cal. Acad.* ii. 36 (1863). — Greene, *West Am. Oaks*, 3, 79, t. 2; *Man. Bot. Bay Region*, 303. — Sargent, *Garden and Forest*, ii. 471.

Quercus Wislizeni × *Kelloggii*, Mary K. Curran, *Bull. Cal. Acad.* i. 146 (1885).

This is a small tree (Plate ccccvii.) rarely more than thirty feet in height, with wide-spreading branches, dark generally smooth bark, and large ovate acute pubescent buds. The leaves are oblong, broad and rounded or cordate at the base, acute at the apex, remotely and coarsely sinuate-lobed with broad subulate and often toothed lobes, dark green and glabrous on the upper and yellow-green and glabrous or stellate-pubescent on the lower surface, from two to four inches long and from one to nearly two inches broad; and, borne on slender glabrous or pubescent petioles sometimes an inch in length, they fall during the winter or early in the spring with the appearance of the new growth. The fruit, which ripens at the end of the second season, is sessile or produced on a short stout peduncle, and is usually solitary; the nut is from an inch to an inch and a half in length, oblong-oval, and rather full at the acute apex; the cup, which incloses two thirds of the nut or sometimes only its base, is deep or shallow, cup-shaped, and covered by thin light brown scarious glabrous or puberulous oblong-ovate scales rounded or acute at the apex.

Quercus Morehus has also been found near Newcastle in Placer County, at Folsom in Sacramento County, on Mt. Tamalpais north of the Golden Gate, and on the hills near Berkeley.

[4] Albert Kellogg (1813–1887) was born at New Hartford, Connecticut, and passed his boyhood on his father's farm in that town. In early youth, after receiving a common-school education, he began the study of medicine with a physician in Middletown, Connecticut, but delicacy of the lungs interfered with his studies and he went to Charleston, South Carolina, where he entered the Medical College. He received his medical degree, however, in Lexington, Kentucky, and then practiced his profession during several years in different parts of Kentucky, Georgia, and Alabama. His early taste for natural history was no doubt confirmed by a chance meeting with Audubon, whose companion he became in a long journey through the Southwest, which eventually brought him to San Antonio, Texas, in 1845. He was in New England again when gold was discovered in California, and joining a party of miners, reached the Pacific coast in August, 1849, having made the voyage from New York in a small schooner. After passing three or four years in the mining districts, Dr. Kellogg established himself in San Francisco, which was his home during the remainder of his life. In 1854 he was one of the seven founders of the California Academy of Sciences, in which he was always deeply interested, and which he faithfully served until his death as curator of the botanical department. As a botanical collector Dr. Kellogg made many journeys in his adopted state, and in 1867, being appointed surgeon and naturalist of the United States Coast Survey, he visited Alaska, where he made an important collection of plants. Never claiming to be a scientific botanist, Dr. Kellogg was an ardent and devoted lover of nature. Particularly interested in trees, he was the author of a work on the forest trees of California which contains picturesque accounts of many of the important inhabitants of the Pacific forests; and his drawings of western Oaks were published after his death by Professor Edward L. Greene in the first part of his *West American Oaks.*

Kelloggia, a monotypic genus of the Sierra Nevada dedicated to him by Torrey, will preserve among botanists the memory of a

The wood of *Quercus Wislizeni* is heavy, very hard, strong, and close-grained; it is light brown tinged with red, with thick lighter colored sapwood, and contains numerous large open ducts arranged in irregular bands parallel to the broad conspicuous medullary rays. The specific gravity of the absolutely dry wood is 0.7855, a cubic foot weighing 48.95 pounds. Sometimes used for fuel, it is not distinguished for this purpose from the wood of *Quercus agrifolia*.

Discovered by Frémont on the Sierra Nevada in the winter of 1844–45,[1] *Quercus Wislizeni*, which was at first confounded with *Quercus agrifolia*, was described from specimens gathered by Dr. F. A. Wislizenus[2] in 1851 on the American fork of the Sacramento River.

gentle, enthusiastic, and simple man of singular purity and uprightness of character. (See *Pittonia*, i. 145.)

[1] *Teste* Herb. Torrey, in which Frémont's specimen is preserved.

[2] See vi. 94.

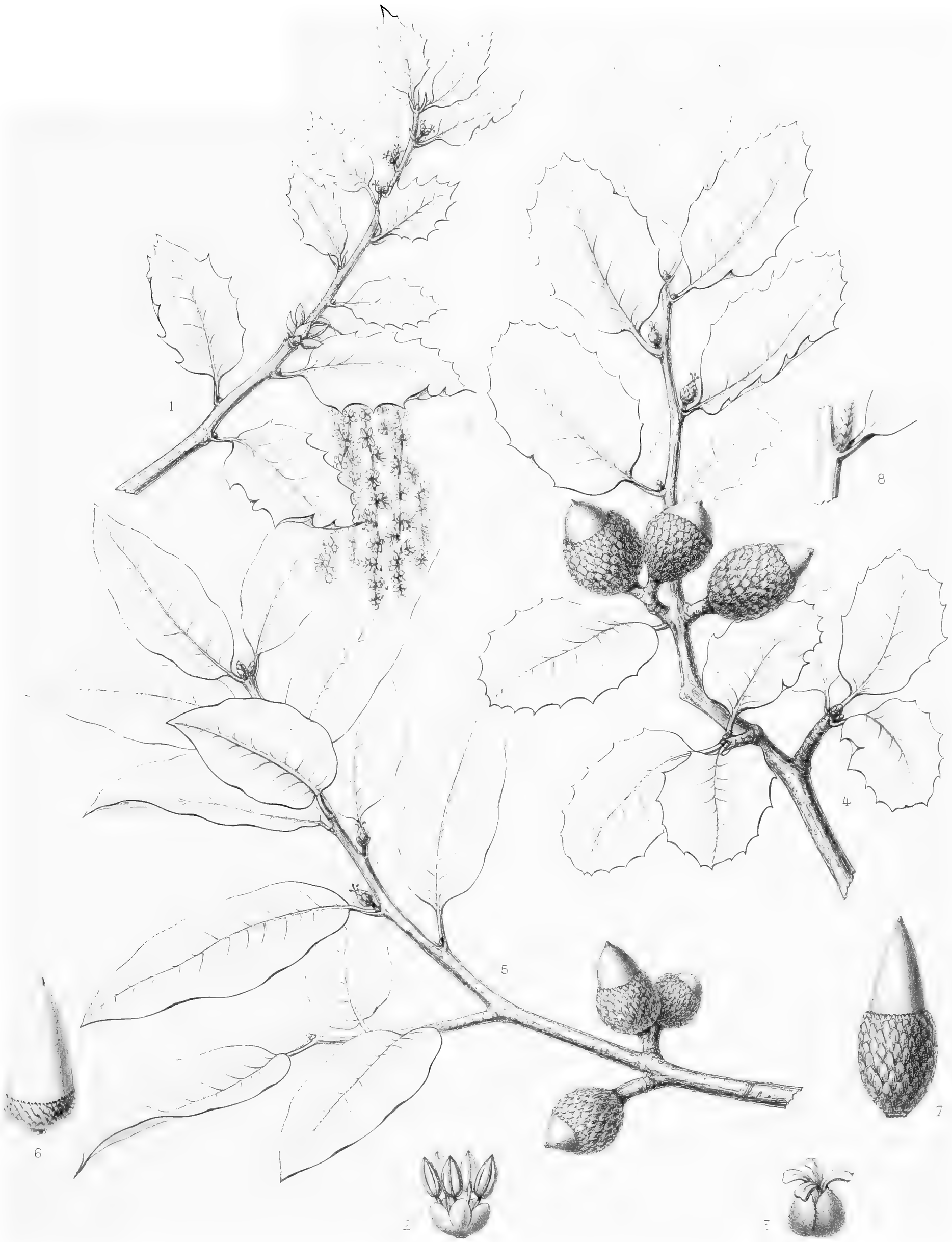
EXPLANATION OF THE PLATES.

Plate CCCCVI. Quercus Wislizeni.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A fruiting branch, natural size.
6. A fruit, natural size.
7. A fruit, natural size.
8. An axillary winter-bud, enlarged.

Plate CCCCVII. Quercus Wislizeni × Californica.

1. A fruiting branch, natural size.
2. A winter branchlet, the leaves removed, natural size.



C.E. Faxon del.

Rapine sc.

QUERCUS WISLIZENI, A.DC.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

C.E.Faxon del. *Himely sc.*

QUERCUS WISLIZENI x CALIFORNICA

(QUERCUS MOHREUS, Kellogg.)

A.Riocreux direx.t *Imp. J. Taneur, Paris.*

QUERCUS MYRTIFOLIA.

Scrub Oak.

LEAVES oval to oblong-obovate, mostly entire, with thickened revolute margins.

Quercus myrtifolia, Willdenow, *Spec.* iv. pt. i. 424 (1805). — Poiret, *Lam. Dict.* Suppl. ii. 213. — Pursh, *Fl. Am. Sept.* ii. 626. — Nuttall, *Gen.* ii. 214. — *Nouveau Duhamel*, vii. 151. — Elliott, *Sk.* ii. 597. — Sprengel, *Syst.* iii. 858. — Dietrich, *Syn.* v. 307. — Engelmann, *Trans. St. Louis Acad.* iii. 396.

Quercus Phellos, var. **arenaria**, Chapman, *Fl.* 420 (1860).

Quercus aquatica, ζ ? **myrtifolia**, A. de Candolle, *Prodr.* xvi. pt. ii. 68 (1864). — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 182.

An intricately branched shrub, with slender rigid stems generally three or four or, sometimes, fifteen or twenty feet high and from one to three inches in diameter, covered by smooth bark which near the ground is dark and slightly furrowed. The slender branches are coated at first with a thick pale or fulvous tomentum of articulate hairs which usually persists during the summer, and in their first winter are light brown more or less tinged with red or dark gray and pubescent or puberulous, becoming darker and glabrous in their second season. The winter-buds are ovate or oval, gradually narrowed to the acute apex and covered by closely imbricated dark chestnut-brown slightly puberulous scales. The leaves are involute in the bud, oval or oblong-obovate, gradually narrowed and wedge-shaped or broad and rounded or cordate at the base, acute and apiculate or broad and rounded at the apex, and entire, with much thickened and revolute, sometimes undulate, but occasionally thin flat margins; or sometimes, on vigorous shoots, the leaves are sinuate-dentate or lobed above the middle; when they unfold they are thin, dark red, and coated below and on the petioles with a clammy rusty tomentum of articulate hairs and covered above with stellate pubescence, and when fully grown are thick and coriaceous, lustrous, dark green, glabrous and conspicuously reticulate-venulose on the upper surface, and paler and yellow-green or light orange-brown on the lower surface, which is glabrous or pubescent and is generally furnished with tufts of rusty hairs in the axils of the veins; often about an inch and a half long and an inch wide, they vary from half an inch to two inches in length and from a quarter of an inch to an inch in width, with conspicuous midribs raised and rounded on the upper side and few mostly obscure primary veins usually forked half way between the midrib and the margins; they are borne on stout pubescent yellow petioles rarely more than an eighth of an inch long and fall gradually during their second season. The stipules are ovate-lanceolate, brown and scarious, and about half an inch in length. The flowers open in April; the staminate are borne on hoary stellate-pubescent aments from an inch to an inch and a half in length, and the pistillate are sessile or subsessile, and solitary or in pairs. The calyx of the staminate flower is coated on the outer surface with rusty hairs and is divided into five ovate acute thin and scarious segments shorter than the stamens, which are generally two or three in number with small acute apiculate yellow glabrous anthers. The involucral scales of the pistillate flower are tomentose and tinged with red, and the stigmas are long and recurved. The fruit, which ripens usually at the end of the second season or occasionally during the first autumn,[1] is solitary or in pairs, and is sessile or borne on a stout peduncle rarely more than a quarter of an inch in length; the nut is subglobose or ovate, acute, from one quarter to one half of an inch in length, dark

[1] The maturation of the fruit of this species is normally biennial, but Dr. J. H. Mellichamp finds at Bluffton, South Carolina, early flowering plants which habitually ripen their fruit in one season; and specimens from Florida show on the same branch acorns that have ripened in one and in two years.

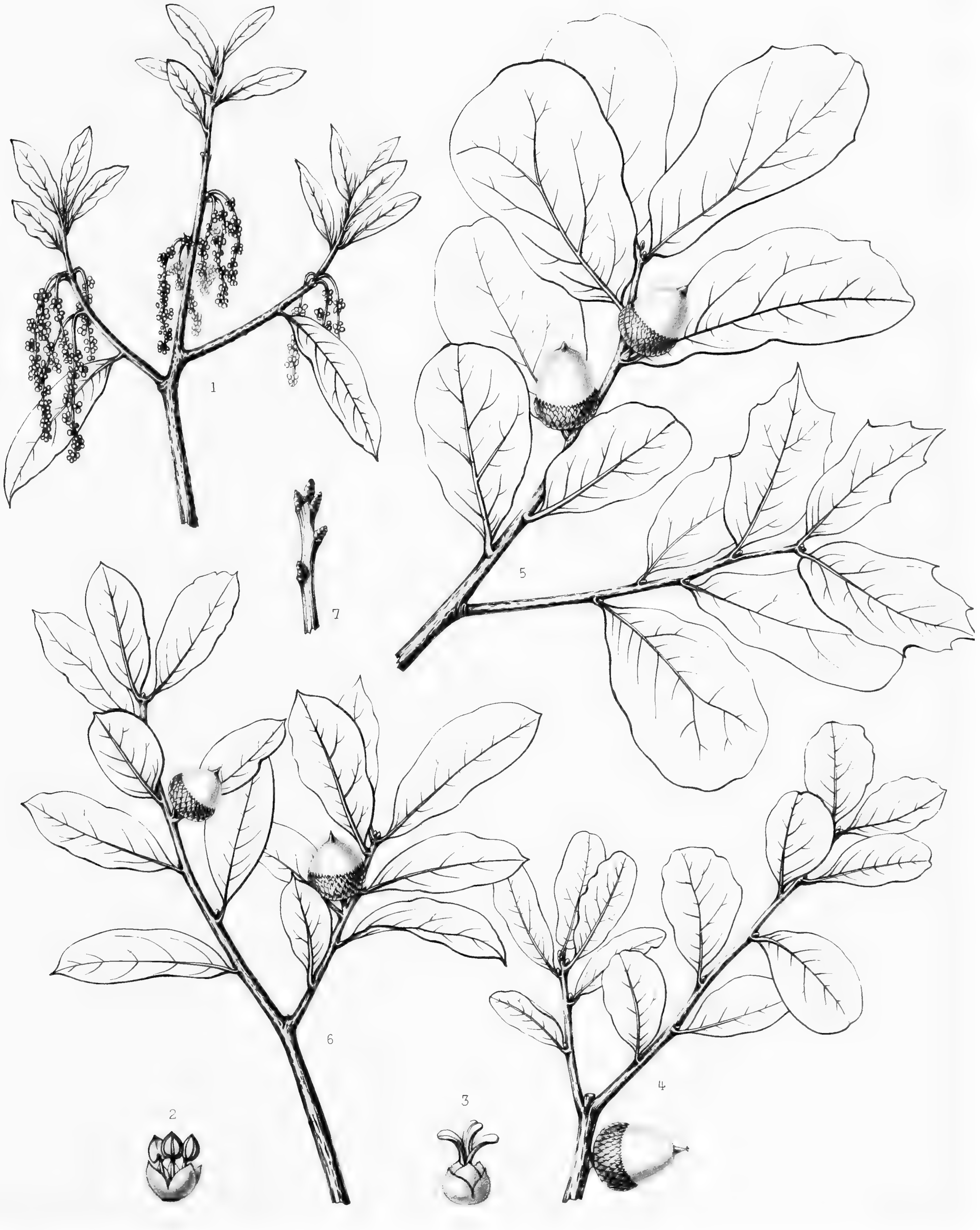
brown, lustrous and often striate, and puberulous at the apex, with a thin shell lined with a thick coat of rusty tomentum, a red seed-coat and deep orange-colored cotyledons; the cup, which embraces from a quarter to a third of the nut, is thin, saucer-shaped or turbinate, light brown and puberulous within, and covered by closely imbricated broadly ovate light brown pubescent scales ciliate on the margins and rounded at the broad apex.

Quercus myrtifolia grows on dry sandy ridges on the seashore and islands of the southern states, where it is distributed from South Carolina to eastern Florida and from the shores of Bay Biscayne to eastern Louisiana. It is most abundant on the islands off the coast of Alabama and Mississippi, often covering large areas with low nearly impenetrable thickets.

EXPLANATION OF THE PLATE.

PLATE CCCCVIII. QUERCUS MYRTIFOLIA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch showing biennial maturation, natural size.
5. A fruiting branch showing annual maturation, natural size.
6. A fruiting branch showing annual maturation, natural size.
7. A winter branchlet, the leaves removed, natural size.



C.E. Faxon del. Toulet sc.

QUERCUS MYRTIFOLIA, Willd.

A. Riocreux direx.t Imp. J. Taneur, Paris.

QUERCUS RUBRA.

Red Oak.

LEAVES oblong-obovate to oblong, pinnatifid-lobed, the lobes tapering gradually from broad bases, and acute and usually dentate at the ends.

Quercus rubra, Linnæus, *Spec.* 996 (1753). — Miller, *Dict.* ed. 8, No. 8. — Muenchhausen, *Hausv.* v. 251. — Du Roi, *Obs.* 35; *Harbk. Baumz.* ii. 265, t. 5, f. 2. — Wangenheim, *Beschreib. Nordam. Holz.* 134 (excl. syn. Gronovius). — Lamarck, *Dict.* i. 720. — Moench, *Bäume Weiss.* 94; *Meth.* 348. — Schoepf, *Mat. Med. Amer.* 138. — Walter, *Fl. Car.* 234. — Castiglioni, *Viag. negli Stati Uniti*, ii. 347. — Willdenow, *Berl. Baumz.* 272 (excl. syn. Walter); *Spec.* iv. pt. i. 445; *Enum.* 976. — Borkhausen, *Handb. Forstbot.* i. 703. — Michaux, *Hist. Chênes Am.* No. 20, t. 35, 36; *Fl. Bor.-Am.* ii. 200. — Persoon, *Syn.* ii. 569. — Desfontaines, *Hist. Arb.* ii. 511. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 423. — Michaux f. *Hist. Arb. Am.* ii. 126, t. 26. — Pursh, *Fl. Am. Sept.* ii. 630. — Bigelow, *Fl. Boston.* 227. — Nuttall, *Gen.* ii. 214. — *Nouveau Duhamel*, vii. 170. — Hayne, *Dendr. Fl.* 157. — Elliott, *Sk.* ii. 602. — Sprengel, *Syst.* iii. 863. — Hooker, *Fl. Bor.-Am.* ii. 158. — Spach, *Hist. Vég.* xi. 165. — Torrey, *Fl. N. Y.* ii. 189, t. 106. — Emerson, *Trees Mass.* 148, t. 10; ed. 2, i. 168, t. — Dietrich, *Syn.* v. 310. — Darlington, *Fl. Cestr.* ed. 3, 269. — Brendel, *Trans. Ill. Agric. Soc.* iii. 369, t. 9. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 41. — Chapman, *Fl.* 422 (in part). — A. de Candolle, *Prodr.* xvi. pt. ii. 60 (in part). — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 72; *Liebmann Chênes Am. Trop.* t. A, B. — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 345. — Koch, *Dendr.* ii. pt. ii. 70. — Engelmann, *Trans. St. Louis Acad.* iii. 394 (in part). — Lauche, *Deutsche Dendr.* 299. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 147 (in part). — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 186. — Houba, *Chênes Am. en Belgique*, 124, t. — Watson & Coulter, *Gray's Man.* ed. 6, 477. — Mayr, *Wald. Nordam.* 146, t. 1; 21. — Dippel, *Handb. Laubholzk.* ii. 117. — Koehne, *Deutsche Dendr.* 133.

Quercus rubra, β, Linnaeus, *Spec.* 996 (1753).

Quercus rubra, b, Du Roi, *Harbk. Baumz.* ii. 261, t. 5, f. 3 (1772).

Quercus rubra, α **latifolia**, Lamarck, *Dict.* i. 720 (1783). — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 423. — Aiton, *Hort. Kew.* ed. 2, v. 292. — Loudon, *Arb. Brit.* iii. 1877.

? **Quercus rubra**, γ **subserrata**, Lamarck, *Dict.* i. 720 (1783). — Castiglioni, *Viag. negli Stati Uniti*, ii. 348.

Quercus rubra maxima, Marshall, *Arbust. Am.* 122 (1785). — Borkhausen, *Handb. Forstbot.* i. 704. — Muehlenberg & Willdenow, *Neue Schrift. Gesell. Nat. Fr. Berlin*, iii. 397.

Quercus rubra montana, Borkhausen, *Handb. Forstbot.* i. 705 (not Marshall) (1800). — Aiton, *Hort. Kew.* ed. 2, v. 292. — Loudon, *Arb. Brit.* iii. 1877. — Dippel, *Handb. Laubholzk.* ii. 118.

Quercus ambigua, Michaux f. *Hist. Arb. Am.* ii. 120, t. 24 (1812). — Pursh, *Fl. Am. Sept.* ii. 630. — Nuttall, *Gen.* ii. 214. — Loudon, *Arb. Brit.* iii. 1881, f. 1479, t. — Dippel, *Handb. Laubholzk.* ii. 120.

Quercus coccinea, β, Spach, *Hist. Vég.* xi. 165 (1842).

Quercus coccinea, var. **ambigua**, Gray, *Man.* ed. 5, 454 (1867). — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 186. — Watson & Coulter, *Gray's Man.* ed. 6, 478.

? **Quercus rubra**, γ **Mühlenbergii**, Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 186 (1885).

Quercus rubra, a **viridis**, Dippel, *Handb. Laubholzk.* ii. 118 (1892).

Quercus rubra, c **Schrefeldii**, Dippel, *Handb. Laubholzk.* ii. 118 (1892).

Quercus rubra, d **heterophylla**, Dippel, *Handb. Laubholzk.* ii. 118 (1892).

Quercus rubra, e **aurea**, Dippel, *Handb. Laubholzk.* ii. 119 (1892).

A tree, usually seventy or eighty or occasionally nearly one hundred and fifty feet in height, with a trunk three or four feet in diameter and stout branches which, spreading gradually, usually form a comparatively narrow round-topped head, or, growing nearly at right angles with the stem, a broader and more symmetrical head. The bark of the trunk is an inch or an inch and a half in thickness, dark brown tinged with red, and divided into broad thin rounded ridges broken into small thick appressed plates scaly on the surface; on young stems and on the upper part of the limbs of large trees it is smooth and light gray. The branchlets are slender, lustrous, and marked with small scattered pale lenticels; when they first appear they are bright green and lustrous and covered with pale scurfy caducous

pubescence, and during their first winter are dark red, becoming more or less tinged with olive-green in their second and third years, and ultimately dark brown. The winter-buds are ovate, gradually narrowed to the acute apex, about a quarter of an inch long, and covered by numerous closely imbricated thin ovate acute light chestnut-brown scales. The leaves are convolute in the bud, generally obovate or oblong in outline, abruptly or gradually wedge-shaped or rounded at the broad or narrow base, and usually divided about half way to the midribs by wide oblique sinuses rounded at the bottom into eleven, or sometimes into seven or nine acute oblique ovate lobes; these taper gradually from broad bases, and are mostly sinuately three-toothed at the apex with elongated bristle-pointed teeth, increasing in size from the bottom of the leaf to those of the last pair but one, which are usually the largest; or sometimes the leaves are oblong-obovate, gradually narrowed and wedge-shaped at the base and sinuate-lobed with broad acute usually entire or slightly dentate lobes; when they unfold they are pink, covered with soft silky pale pubescence on the upper surface and clothed on the lower with thick white tomentum, but soon become nearly glabrous, and when about one third grown are light green and very lustrous, and hang on their long stalks close against the branchlet; at maturity they are thin and firm, dark green, dull and glabrous on the upper surface, and on the lower surface paler yellow-green, glabrous or rarely puberulous, and sometimes furnished with small tufts of rusty hairs in the axils of the veins; they are from five to nine inches long and from four to six inches broad, with slender yellow midribs and primary veins which are rounded, conspicuous and often red above, especially the midrib toward the base of the leaf, obscure lateral veins arcuate and united near the slightly thickened margins, and conspicuous reticulate veinlets; they are borne on stout yellow or red petioles from one to two inches long, and fall rather early in the autumn after having turned a dull or sometimes a bright orange-color or brown. The stipules are linear-lanceolate, thin and scarious, at first white but soon light brown, about two thirds of an inch in length and caducous. The flowers appear when the leaves are about half grown, the staminate borne on slender pedicels about one twelfth of an inch long in pubescent aments four or five inches in length, and the pistillate on short glabrous peduncles. The young bud of the staminate flower is pink but soon turns green and is furnished at the apex with a tuft of slender pale hairs; the calyx is deeply divided into four or five narrow ovate rounded lobes shorter than the stamens, which are usually four or five in number, with large oblong emarginate glabrous yellow anthers. The bud of the pistillate flower is bright red and tipped with a cluster of white hairs; the involucral scales are broadly ovate, dark reddish brown, shorter than the conspicuous linear acute bract of the flower, and as long as the lanceolate acute calyx-lobes or much shorter; the stigmas are elongated, spreading, and bright green. The fruit, which ripens in the autumn of the second year, is solitary or in pairs and sessile or borne on a thick peduncle rarely more than a quarter of an inch in length; the nut is oblong-ovoid or oval, with a broad base, and is full or gradually narrowed and rounded at the apex, from three quarters of an inch to an inch and a quarter long and from half an inch to an inch wide; the cup, which embraces only the base or sometimes nearly a quarter of the nut, is thick, shallow and saucer-shaped, or turbinate, with a thin or thick rim, and is reddish brown and puberulous within and covered by thin closely imbricated ovate acute bright red-brown puberulous scales.[1]

[1] A tree found by Dr. Engelmann on the bottom-lands of the Mississippi River opposite St. Louis (*Quercus rubra*, β *runcinata*, A. de Candolle, *Prodr.* xvi. pt. ii. 60 (1864). — Gray, *Man.* ed. 5, 454. — Engelmann, *Trans. St. Louis Acad.* iii. 394. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 186), with oblong narrow acutely dentate or entire-lobed leaves and small fruit, recalls in the ferrugineous color of the lower surface of the leaves and in their occasionally falcate lobes some forms of *Quercus digitata*, and is possibly a hybrid between that species and *Quercus rubra*.

A tree, found in 1893 by Mr. B. F. Bush (*Garden and Forest*, viii. 33) one mile east of Independence, Missouri, has the appearance, as suggested by the discoverer, of being a hybrid between *Quercus rubra* and *Quercus imbricaria*. The leaves are three or four inches long, oblong-obovate, rounded at the base, sinuate-dentate with bristly pointed teeth, and pubescent on the lower surface. The fruit resembles in the shape of the nut and cup that of *Quercus rubra*, but is only three quarters of an inch long.

A tree about forty feet high found by Professor T. C. Porter on College Hill in Easton, Pennsylvania, has the winter-buds and the fruit of *Quercus velutina*, but the leaves resemble in general outline those of *Quercus rubra*, although they are coated on the lower surface when fully grown with pale pubescence and furnished

Quercus rubra, which is the most boreal of the Oak-trees of eastern America, generally inhabits rich uplands, growing to a large size on glacial drift and the well-drained borders of streams and swamps. It ranges from Nova Scotia and southern New Brunswick through Quebec, where it reaches the banks of the St. Lawrence in about latitude 47° 50′ north, along the northern shores of Lake Huron to the neighborhood of Lake Namekagon on the divide west of Lake Superior,[1] southward to middle Tennessee, and Virginia and along the high Appalachian Mountains to northern Georgia, and westward to eastern Nebraska[2] and central Kansas.[3] Rare and of small size toward the northern limits of its range, the Red Oak is abundant in Nova Scotia, southern Quebec, and Ontario; it is one of the largest and most common trees in the forests of the northern states with the exception of those which cover the mountains of northern New England and New York, and reaches its largest size in the states north of the Ohio River. Farther south it is less common and usually small, and on the southern Alleghany Mountains is exceedingly rare.

The wood of *Quercus rubra* is heavy, hard, strong, coarse-grained, and liable to check badly in drying; it is light or reddish brown, with thin darker colored sapwood, and contains remote conspicuous medullary rays and bands of several rows of large open ducts marking the layers of annual growth. The specific gravity of the absolutely dry wood is 0.6621, a cubic foot weighing 41.25 pounds. It is used in construction, for the interior finish of houses, and in the manufacture of cheap furniture.

Quercus rubra was introduced[4] into Bishop Compton's garden[5] near London before the end of the seventeenth century, and the earliest account of it, prepared from these cultivated trees, was published by Plukenet in 1692.[6]

Endowed with a constitution which enables it to withstand climatic conditions unlike those of its native land, *Quercus rubra*[7] has succeeded in Europe better than any other American Oak, and individuals more than a century old may be seen in England, France, and Germany.[8] No Oak of the northern states grows more rapidly or can more easily be transplanted, and few trees are better suited to ornament the parks and roadsides of the northern United States.[9]

with conspicuous tufts of hairs in the axils of the veins, and at maturity are glabrous or puberulous below; it is probably a hybrid between these species.

Usually well characterized by its large nut and flat shallow cup, and by the numerous lateral lobes of the leaf which taper gradually from their broad bases, *Quercus rubra* near the northern borders of the United States and British America often bears leaves with fewer lobes and smaller fruit with turbinate cups (*Quercus ambigua*, Michaux), but these extreme forms are so intermixed and inconstant that it does not seem practicable to consider them even varieties.

[1] Brunet, *Cat. Vég. Lig. Can.* 49. — Bell, *Geolog. Rep. Can.* 1879–80, 51°. — Macoun, *Cat. Can. Pl.* 442.

[2] Bessey, *Rep. Nebraska State Board Agric.* 1894, 110.

[3] Mason, *Eighth Bienn. Rep. State Board Agric. Kansas*, 272 (in part).

[4] Aiton, *Hort. Kew.* iii. 357. — Loudon, *Arb. Brit.* iii. 1877, f. 1740–1744, t.

[5] See i. 6.

[6] *Quercus Esculi divisurâ, foliis amplioribus aculeatis, Phyt.* t. 54, f. 4; *Alm. Bot.* 309 (excl. syn.). — Catesby, *Nat. Hist. Car.* i. 23, t. 23 (fruit).

? Quercus Virginiana rubris venis, muricata, Plukenet, *Phyt.* t. 54, f. 5; *Alm. Bot.* 309. — Miller, *Dict.* No. 7. — Duhamel, *Traité des Arbres*, ii. 203.

? Quercus Carolinensis virentibus venis muricata, Catesby, *Nat. Hist. Car.* i. 21, t. 21.

[7] In Maine *Quercus rubra* is sometimes called Yellow Oak.

[8] Wesmael, *Garden and Forest*, iii. 129. — R. Hartig, *Ausl. Holz. Bayer. Staatswald.* 38 (*Forst.-nat. Zeit.* 1892).

In German collections a number of varieties, including one with yellow leaves, are occasionally cultivated (Dippel, *Handb. Laubholzk.* ii. 118).

[9] *Garden and Forest*, iv. 337, f. 58.

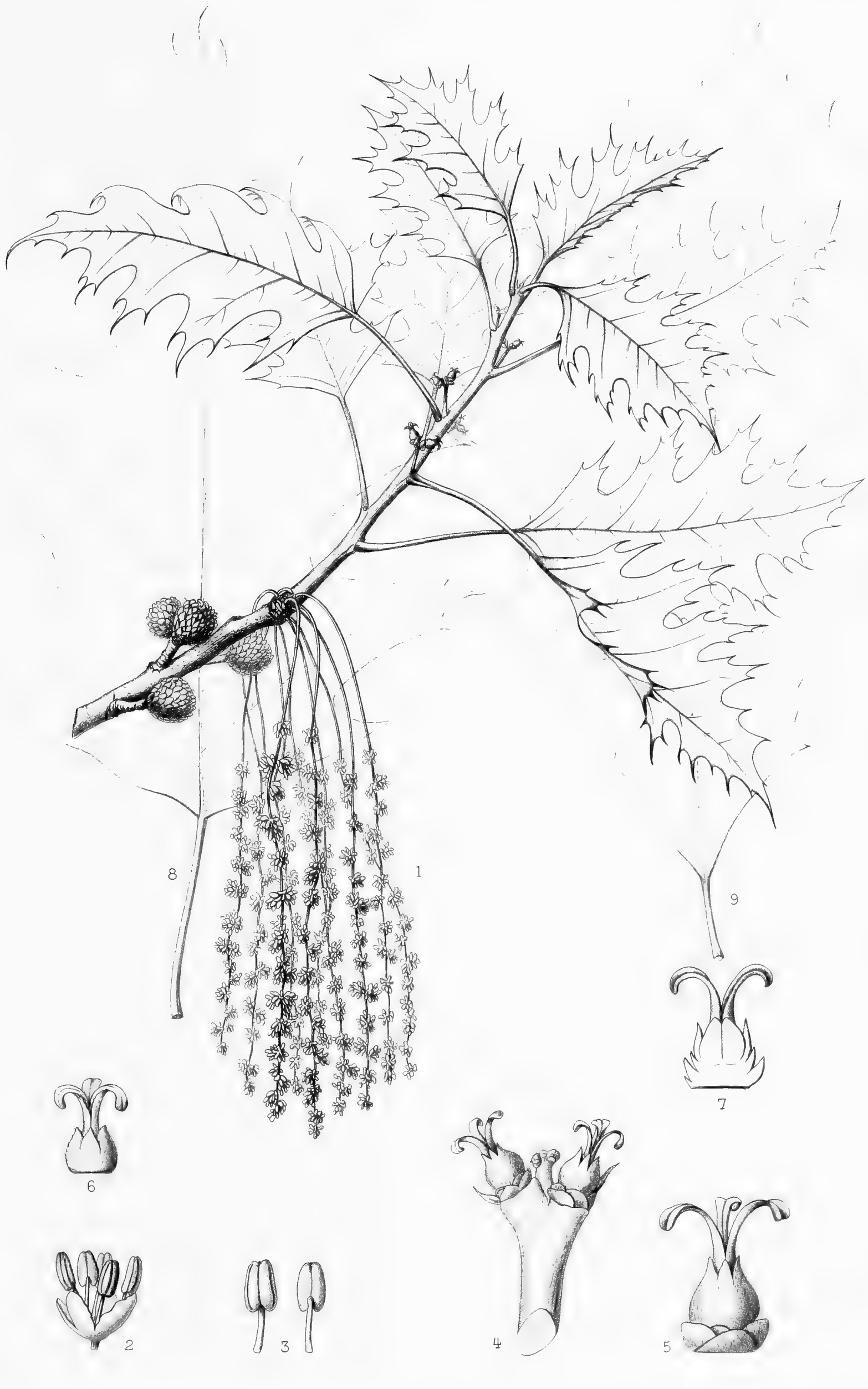
EXPLANATION OF THE PLATES.

Plate CCCCIX. Quercus rubra.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A stamen, front and rear view, enlarged.
4. A pistillate inflorescence, enlarged.
5. A pistillate flower, enlarged.
6. A pistillate flower, the involucre removed, enlarged.
7. Vertical section of a pistillate flower before fecundation, enlarged.
8. A leaf, natural size.
9. A leaf, natural size.

Plate CCCCX. Quercus rubra.

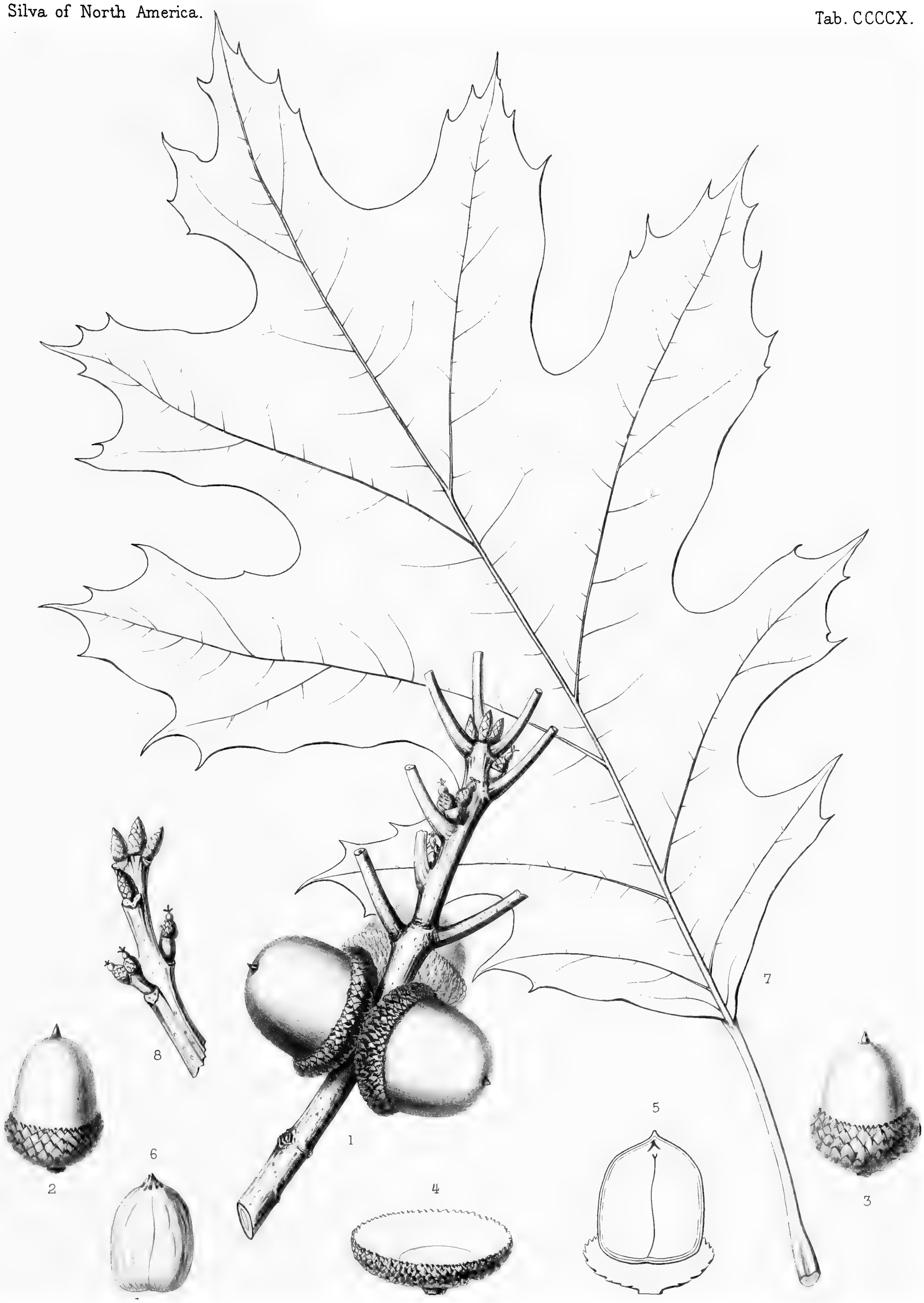
1. A fruiting branch, natural size.
2. A fruit, natural size.
3. A fruit, natural size.
4. A cup, natural size.
5. Vertical section of a fruit, natural size.
6. A seed, natural size.
7. A leaf, natural size.
8. A fertile winter branchlet, natural size.



C.E.Faxon del. *Lebrun sc.*

QUERCUS RUBRA, L.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*



C.E.Faxon del. Himely sc.

QUERCUS RUBRA, L.

A.Riocreux direx.t Imp. J.Taneur, Paris.

QUERCUS TEXANA.

Red Oak.

LEAVES obovate, truncate or abruptly wedge-shaped at the base, deeply pinnatifid-lobed with broad rounded sinuses, the lobes sinuate-dentate at the usually broad apex.

Quercus Texana, Buckley, *Proc. Phil. Acad.* 1860, 444. — Young, *Bot. Texas*, 507. — Sargent, *Garden and Forest*, vii. 514, f. 81, 82.

Quercus palustris, Torrey & Gray, *Pacific R. R. Rep.* ii. pt. iii. 175 (not Muenchhausen) (1855). — Chapman, *Fl.* ed. 2, Suppl. 649. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 417 (*Man. Pl. W. Texas*).

Quercus coccinea var. ? **microcarpa**, Torrey, *Bot. Mex. Bound. Surv.* 206 (1858).

Quercus rubra, Chapman, *Fl.* 422 (in part) (1860). — A. de Candolle, *Prodr.* xvi. pt. ii. 60 (in part). — Engelmann, *Trans. St. Louis Acad.* iii. 394 (in part). — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 147 (in part). — Watson & Coulter, *Gray's Man.* ed. 6, 477 (in part).

Quercus coccinea, Chapman, *Fl.* 422 (in part) (1860). — Watson, *Proc. Am. Acad.* xviii. 156. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 148 (excl. hab. Florida).

Quercus rubra, var. **Texana**, Buckley, *Proc. Phil. Acad.* 1881, 123. — Engelmann, *Bot. Gazette*, vii. 14. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 148.

A tree, occasionally almost two hundred feet in height, with a trunk free of branches for eighty or ninety feet and seven or eight feet in diameter above a much enlarged and strongly buttressed base, and comparatively small branches which spread into a narrow open head; often much smaller and toward the western limits of its range in Texas usually not more than thirty or forty feet tall, or sometimes reduced to a shrub. The bark of the trunk is from three quarters of an inch to an inch and a half in thickness, light brown tinged with red, and divided into broad ridges broken into thick square plate-like scales; that of young trunks and branches is thin, smooth, and light gray. The branchlets are stout, brittle, and marked with oblong pale lenticels, and when they first appear are coated with hoary pubescence, but soon become glabrous and bright green; during their first winter they are lustrous, orange or reddish brown, and in their second season ashy gray or dark brown. The winter-buds are ovate or obovate, full and abruptly rounded at the apex, and from one eighth to one quarter of an inch long, with thin closely imbricated dark brown scales. The leaves are convolute in the bud, obovate in outline, truncate or abruptly or rarely gradually wedge-shaped at the broad base, and usually seven, rarely nine, or sometimes five-lobed by wide or narrow oblique sinuses rounded at the bottom; the terminal lobe is oblong, dentate or entire toward the acute apex, and furnished with two spreading lateral teeth; the lateral lobes are contracted below the broad apex or occasionally taper from the base, and above the middle are coarsely repandly dentate with slender bristle-pointed teeth; they increase in size from the lowest, which are frequently triangular and entire, to the upper, which are usually broader and longer than those below them, although frequently the middle lobes are the largest, or in western Texas, where the leaves are often five-lobed, the lateral lobes are often nearly triangular and entire or obscurely dentate; when they unfold the leaves are light red and coated with pale scurfy pubescence which is thickest on the lower side; this soon disappears, and when they are fully grown they are thin and firm, bright green, lustrous and glabrous above and on the lower surface paler and furnished with large tufts of pale hairs in the axils of the primary veins, from two and a half to six inches long and from two to five inches broad, with slender red or yellow midribs and primary veins raised and rounded on the upper side, and obscure lateral veins arcuate and united within the thick cartilaginous margins and connected by fine reticulate veinlets, which are more prominent above than below; they are borne on slender nearly terete reddish petioles from one to two inches in length, and late in the autumn turn

gradually dark vinous red or brown, or often change color but slightly before falling. The stipules are oblong-obovate, light brown, thin and scarious, from one half to three quarters of an inch long, and caducous. The flowers appear from the middle of March in Texas to the beginning of May in Illinois, the staminate borne in slender slightly pubescent aments from two to three inches in length, the pistillate on short peduncles clothed with hoary tomentum. The calyx of the staminate flower is thin and scarious, villous on the outer surface, and divided into four or five acute laciniately cut segments shorter than the stamens, which are usually four in number, with oblong slightly emarginate glabrous yellow anthers. The involucral scales of the pistillate flower are brown tinged with red and pubescent, and the stigmas are recurved and often bright red. The fruit, which ripens at the end of the second summer, is sessile or raised on a short peduncle occasionally half an inch long, and is usually solitary; the nut is oval, abruptly narrowed and rounded at the base, full and rounded or gradually or abruptly narrowed and rounded at the apex, puberulous, light reddish brown and sometimes conspicuously striate with broad longitudinal dark bands, and from half an inch to an inch and a half in length; the cup, which embraces from one third to one half of the nut, is turbinate or deeply cup-shaped, light reddish brown and puberulous within, and covered by thin closely imbricated ovate light brown scales rounded at the narrow ends and coated, except on the red-brown margins, with thick hoary tomentum.

Quercus Texana is distributed from northeastern Iowa[1] and central Illinois, through southern Illinois and Indiana and western Kentucky and Tennessee, to the valley of the Appalachicola River in Florida, and through southern Missouri, Arkansas,[2] and Louisiana to the Limpio Mountains in western Texas.[3] On the low river bottom-lands of the Mississippi basin, growing with the Swamp White Oak, the Red Maple, the Sour Gum, the Liquidambar, the Pin Oak, and the Swamp Cottonwood, it attains its largest size and is exceedingly common, especially in western Mississippi, southern Arkansas, and eastern Texas, where it frequently forms a great part of the lowland forest. It is less abundant in the southern portions of the eastern Gulf states and probably does not reach the coast. In western Texas it often grows on low limestone hills with the Post Oak and the Western Cedar, and is then a small tree or occasionally a shrub, or becomes a larger tree on the moister bottom-lands in the neighborhood of streams.[4]

The wood of a small specimen of *Quercus Texana* grown on the limestone hills near Austin, Texas, is heavy, hard, and close-grained, light reddish brown, with few conspicuous medullary rays and bands of small ducts marking the layers of annual growth. The specific gravity of the absolutely dry wood is 0.9080, a cubic foot weighing 56.59 pounds. This determination probably does not represent the value of the wood of *Quercus Texana* from the Mississippi valley, as lumbermen and manufacturers consider it more valuable than that of the eastern Red Oak, with which it has always been confounded.

Quercus Texana was discovered near the mouth of the Pecos River in Texas by the botanists of the United States and Mexican Boundary Commission in 1850. As a street tree it is frequently planted in Carrollton, a suburb of New Orleans, where it also grows spontaneously.

Quercus Texana, which sometimes grows to a greater height than any other American Oak,[5] may

[1] *Quercus Texana* was discovered near Waterloo, Iowa, by Professor A. S. Hitchcock in 1889.

[2] Harvey, *Am. Jour. Forestry*, i. 454 (*Quercus rubra*).

[3] Havard, *Proc. U. S. Nat. Mus.* viii. 505.

[4] There is still much to learn with regard to the distribution of this tree. The fact that it is so common and grows with such luxuriance at the mouth of the White River in Indiana would indicate that it might be looked for much farther north than it is now known to grow in Indiana, and that it probably extends into Ohio. Possibly, as suggested by Ridgway (*Bot. Gazette*, viii. 349, as *Quercus rubra*), it was this tree which was found by William Bartram near Little River in Georgia, and which, without description, he called *Quercus tinctoria*. "To keep within the bounds," he says (*Travels*, 37), "of truth and reality in describing the magnitude and grandeur of these trees, would, I fear, fail of credibility; yet, I think I can assert, that many of the black oaks measured eight, nine, ten, and eleven feet diameter five feet above the ground, as we measured several that were above thirty feet girt, and from hence they ascend perfectly strait, with a gradual taper, forty or fifty feet to the limbs; but, below five or six feet, these trunks would measure a third more in circumference, on account of the projecting jambs, or supports, which are more or less, according to the number of horizontal roots that they arise from." I have found, however, no evidence except Bartram's description of the enlarged and buttressed bases of these trees to prove that *Quercus Texana* grows in any of the Atlantic states.

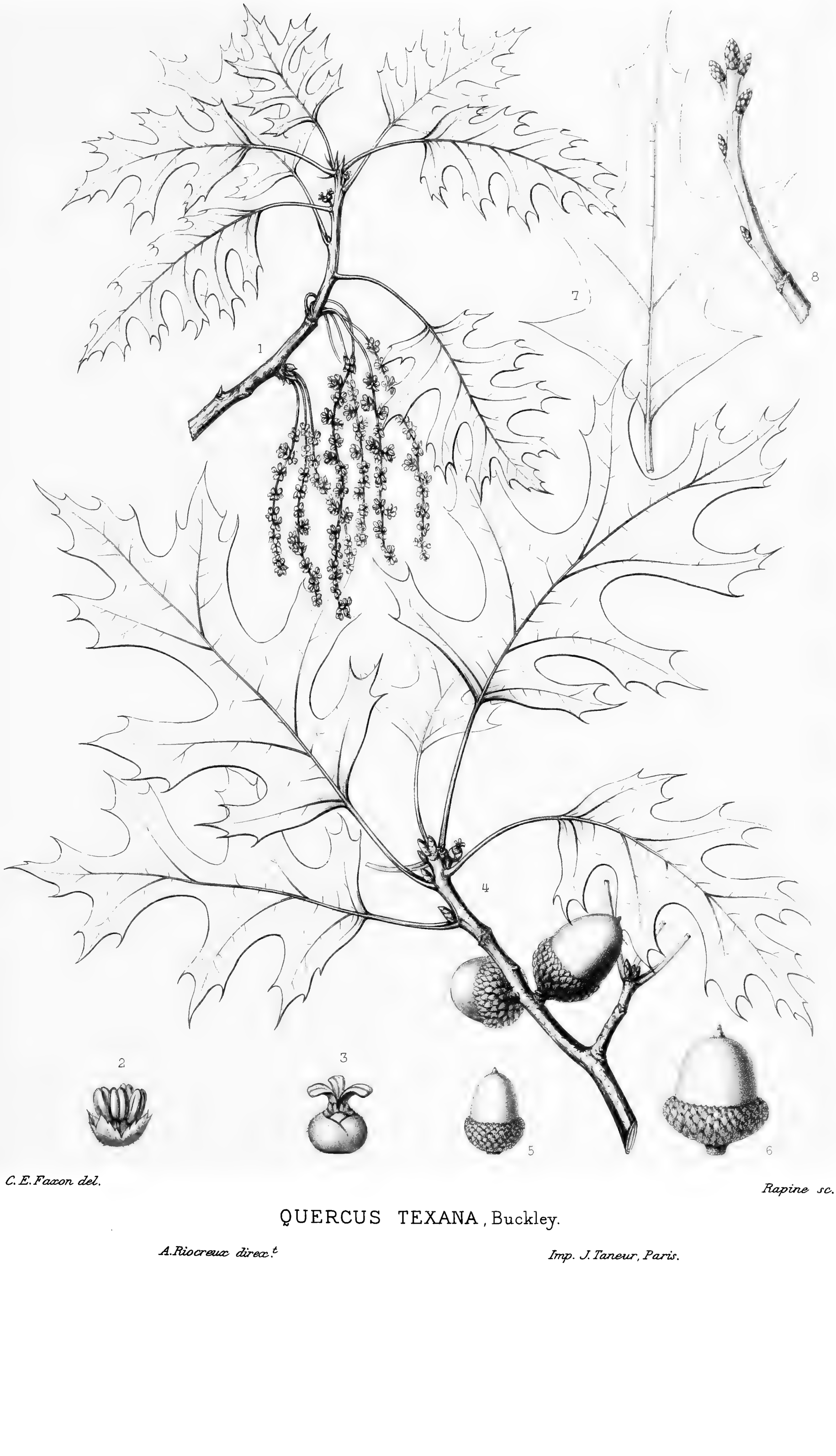
[5] Ridgway, *Proc. U. S. Nat. Mus.* v. 80 (*Quercus coccinea*), 83 (*Quercus rubra*).

be easily distinguished from *Quercus rubra* by its shorter and broader winter-buds, by the deeper and wider sinuses of its smaller and more lustrous leaves, and by its deeper, paler, and more tomentose cups. In Indiana, Illinois, and Missouri it is not possible to distinguish it from *Quercus palustris*, with which it grows, except by its fruit and by the enlarged and buttressed base of its trunk. The leaves also resemble those of *Quercus coccinea*, although this species does not grow in the same situations and probably not in the same region.

EXPLANATION OF THE PLATE.

PLATE CCCCXI. QUERCUS TEXANA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A fruit from the valley of the Pecos River, natural size.
6. A fruit from near the mouth of White River, Illinois, natural size.
7. A leaf from western Texas, natural size.
8. A winter branchlet, natural size.



C. E. Faxon del.

Rapine sc.

QUERCUS TEXANA, Buckley.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

QUERCUS COCCINEA.

Scarlet Oak.

LEAVES oblong or obovate, light green and lustrous, deeply lobed, with broad rounded sinuses, the slender lobes coarsely repandly dentate toward the apex.

Quercus coccinea, Muenchhausen, *Hausv.* v. 254 (excl. b) (1770). — Wangenheim, *Nordam. Holz.* 44, t. 4, f. 9. — Muehlenberg & Willdenow, *Neue Schrift. Gesell. Nat. Fr. Berlin*, iii. 398. — Michaux, *Hist. Chênes Am.* No. 18, t. 31, 32; *Fl. Bor.-Am.* ii. 199. — Willdenow, *Spec.* iv. pt. i. 445; *Enum.* 976; *Berl. Baumz.* ed. 2, 343. — Persoon, *Syn.* ii. 569. — Desfontaines, *Hist. Arb.* ii. 511. — Poiret, *Lam. Dict.* Suppl. ii. 221. — Michaux f. *Hist. Arb. Am.* ii. 116, t. 23. — Pursh, *Fl. Am. Sept.* ii. 630. — Bigelow, *Fl. Boston.* 227. — Nuttall, *Gen.* ii. 214. — *Nouveau Duhamel*, vii. 171. — Hayne, *Dendr. Fl.* 157. — Elliott, *Sk.* ii. 602. — Sprengel, *Syst.* iii. 863. — Loudon, *Arb. Brit.* iii. 1879, f. 1746–1748, t. — Spach, *Hist. Vég.* xi. 165. — Torrey, *Fl. N. Y.* ii. 189. — Emerson, *Trees Mass.* 144, t. 9; ed. 2, i. 163, t. — Dietrich, *Syn.* v. 310. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 40. — Chapman, *Fl.* 422. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 72; *Liebmann Chênes Am. Trop.* t. B. — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 347 (excl. var. β). — Koch, *Dendr.* ii. pt. ii. 69. — Engelmann, *Trans. St. Louis Acad.* iii. 394 (excl. var. *tinctoria*). — Houba, *Chênes Am. en Belgique*, 203, t. — Lauche, *Deutsche Dendr.* 299, f. 120. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 148 (excl. hab. Florida). — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 185 (excl vars. β and γ). — Watson & Coulter, *Gray's Man.* ed. 6, 477 (excl. var. *tinctoria*). — Mayr, *Wald. Nordam.* 147, t. 1, 2. — Dippel, *Handb. Laubholzk.* ii. 119, f. 56. — Koehne, *Deutsche Dendr.* 132.

? **Quercus rubra**, β **coccinea**, Aiton, *Hort. Kew.* iii. 357 (1789).

Quercus coccinea, α **coccinea**, A. de Candolle, *Prodr.* xvi. pt. ii. 61 (1864).

A tree, seventy or eighty feet in height, with a trunk from two to three feet in diameter and comparatively small branches which spread gradually and form a rather narrow open head; or usually much smaller. The bark of the trunk is red internally, from half an inch to an inch in thickness, and divided by shallow fissures into irregular ridges covered by small light brown scales slightly tinged with red; that of the young stems and the branches is smooth and light brown. The branchlets are slender and marked by small scattered pale lenticels, and when they first appear are coated with loose scurfy caducous pubescence but soon become light green and lustrous, and during their first winter are light red or orange-red and in their second year light or dark brown. The winter-buds are oval or ovate, gradually narrowed to the acute apex, from an eighth to a quarter of an inch long, dark reddish brown, and covered above the middle with loose pale pubescence. The leaves are convolute in the bud, oblong, obovate or oval in outline, truncate or wedge-shaped at the base, and deeply divided by wide sinuses, which are rounded at the bottom, into seven or rarely into nine lobes repandly dentate at the apex with slender bristle-pointed teeth; the terminal lobe is ovate, acute and three-toothed, the middle division being much longer than the others and furnished with two small lateral teeth near its narrow apex; the lateral lobes are obovate, oblique or spreading and sometimes falcate, and usually broad and oblique at the coarsely toothed apex, the middle lobes being much larger than those below and above them; or occasionally the leaves are slightly sinuate-lobed with broad or acute dentate lobes; when they unfold they are bright red, covered with loose pale pubescence on the upper surface and coated on the lower with silvery white tomentum; they become green at the end of a few days, and when half grown are thin and lustrous, pubescent above and still covered below with tomentum which now gradually disappears; and at maturity they are thin and firm, bright green, glabrous and very lustrous above, paler and less lustrous below, where they are sometimes furnished with small tufts of rusty pubescence in the axils of the veins,[1] from three to six inches long and from two and a half to four inches broad,

[1] In the eastern states the mature leaves of *Quercus coccinea* are usually glabrous, but in Illinois and Minnesota they are often furnished with tufts of hairs in the axils of the veins, and such leaves are not distinguishable from those of *Quercus Texana*.

with slender yellow midribs and primary veins rounded on the upper side and obscure lateral veins connected by coarsely reticulate veinlets; they are borne on slender terete petioles from one and a half to two and a half inches in length, and late in the autumn before falling turn a brilliant scarlet color. The stipules are obovate-lanceolate to linear-lanceolate, brown and scarious, and from one half to two thirds of an inch long. The flowers appear when the leaves are about half grown, the staminate borne in slender glabrous aments three or four inches in length, the pistillate on pubescent peduncles sometimes half an inch long. The calyx of the staminate flower is pubescent, and before opening is bright red and tipped with a tuft of pale hairs; it is divided into four or five ovate acute segments shorter than the stamens, which are usually four in number, with ovate apiculate light yellow glabrous anthers. The pistillate flower is bright red, with ovate pubescent involucral scales shorter than the acute calyx-lobes, and elongated spreading recurved stigmas. The fruit, which ripens in the autumn of the second year, is sessile or often borne on a stout peduncle sometimes almost an inch in length, and is solitary or in pairs; the nut is oval, oblong-ovate or hemispherical, truncate or rounded at the base, rounded at the apex, from half an inch to nearly an inch long and from one third to two thirds of an inch broad, light reddish brown and occasionally striate, with a thin shell lined with a thick coat of light reddish brown tomentum; the cup, which incloses from one third to one half of the nut, is deeply cup-shaped or turbinate, thin, light reddish brown on the inner surface, and covered by closely imbricated oblong-ovate acute light reddish brown slightly puberulous scales.

The Scarlet Oak inhabits light, dry, and usually sandy soil, and is distributed from the valley of the Androscoggin River in Maine[1] through southern New Hampshire and Vermont and central New York to southern Ontario,[2] westward through central Michigan and Minnesota to southeastern Nebraska,[3] and southward to the District of Columbia[4] and northern Illinois, and along the Alleghany Mountains to North Carolina. It is extremely abundant in the coast region from the southern shores of Massachusetts Bay, where, on light sandy soil, it often forms a large part of the forest growth, to southern New Jersey; it is less abundant in the interior, growing on dry gravelly uplands with the Black Oak, the Red Oak, and the Pignut Hickory; and in the prairie region of Minnesota it is mixed with the Bur Oak in the scattered groves that form the outposts of the eastern forests.

The wood of *Quercus coccinea* is heavy, hard, and strong but coarse-grained, and is light or reddish brown, with thick darker colored sapwood, and contains thin conspicuous medullary rays and bands of large open ducts marking the layers of annual growth. The specific gravity of the absolutely dry wood is 0.7095, a cubic foot weighing 42.20 pounds.

Quercus coccinea is chiefly valuable for the brilliant scarlet color which its leaves assume late in the autumn after those of most of its companions have fallen. The autumn colors of the foliage of no other American tree are more splendid or retain for a longer time their beauty, which is often intensified by the first snowflakes of winter. Less commonly planted in parks and pleasure-grounds than the Red Oak and the Pin Oak, the hardiness and rapid growth of the Scarlet Oak and the beauty of its foliage make it a most desirable ornamental tree.

[1] At South Poland, *teste* M. L. Fernald.

[2] Macoun, *Cat. Can. Pl.* 443.

[3] Bessey, *Rep. Nebraska State Board Agric.* 1894, 110.

[4] L. F. Ward, *Bull. U. S. Nat. Mus.* No. 22, 113 (*Fl. Washington*).

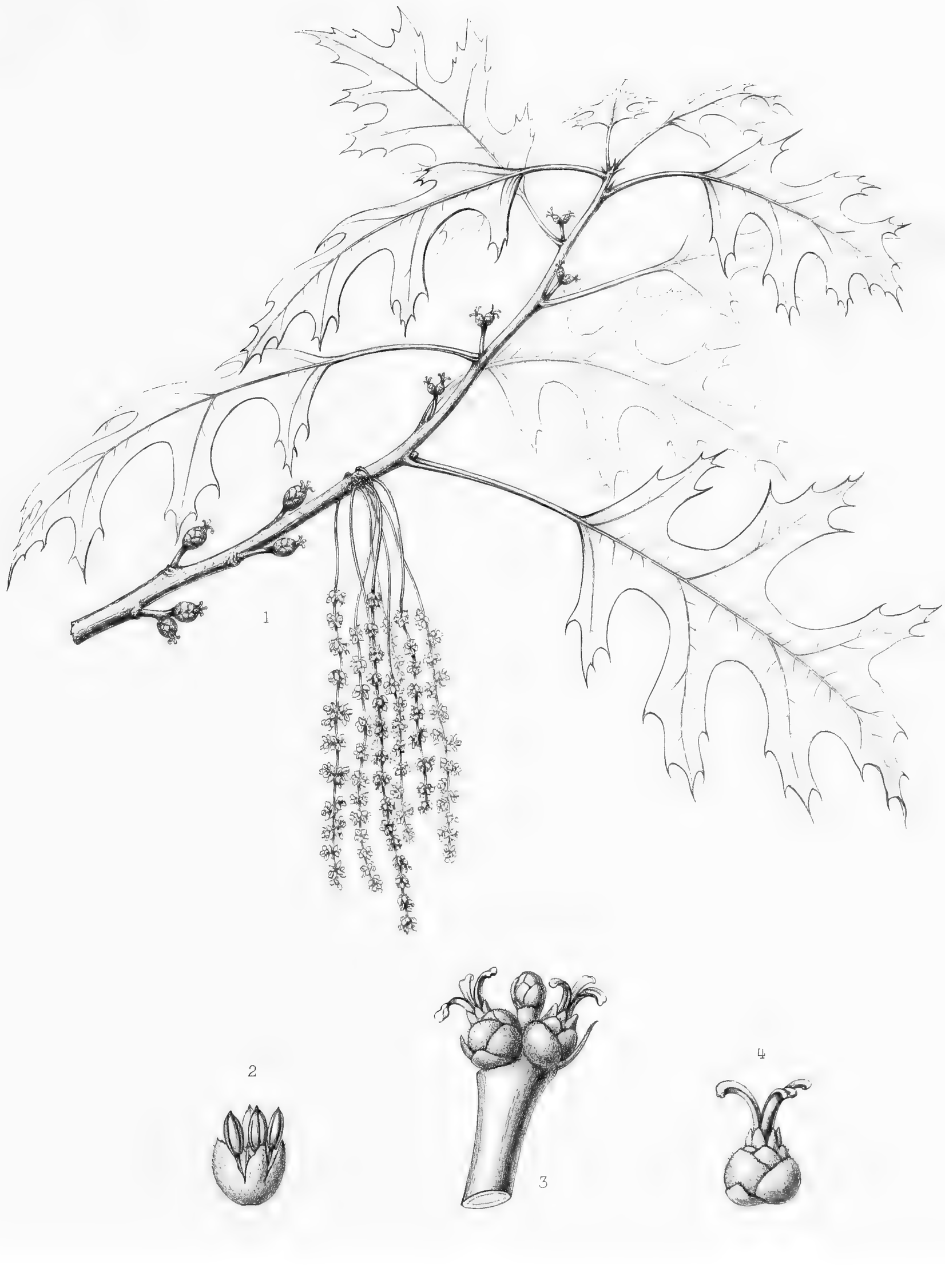
EXPLANATION OF THE PLATES.

Plate CCCCXII. Quercus coccinea.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate inflorescence, enlarged.
4. A pistillate flower, enlarged.

Plate CCCCXIII. Quercus coccinea.

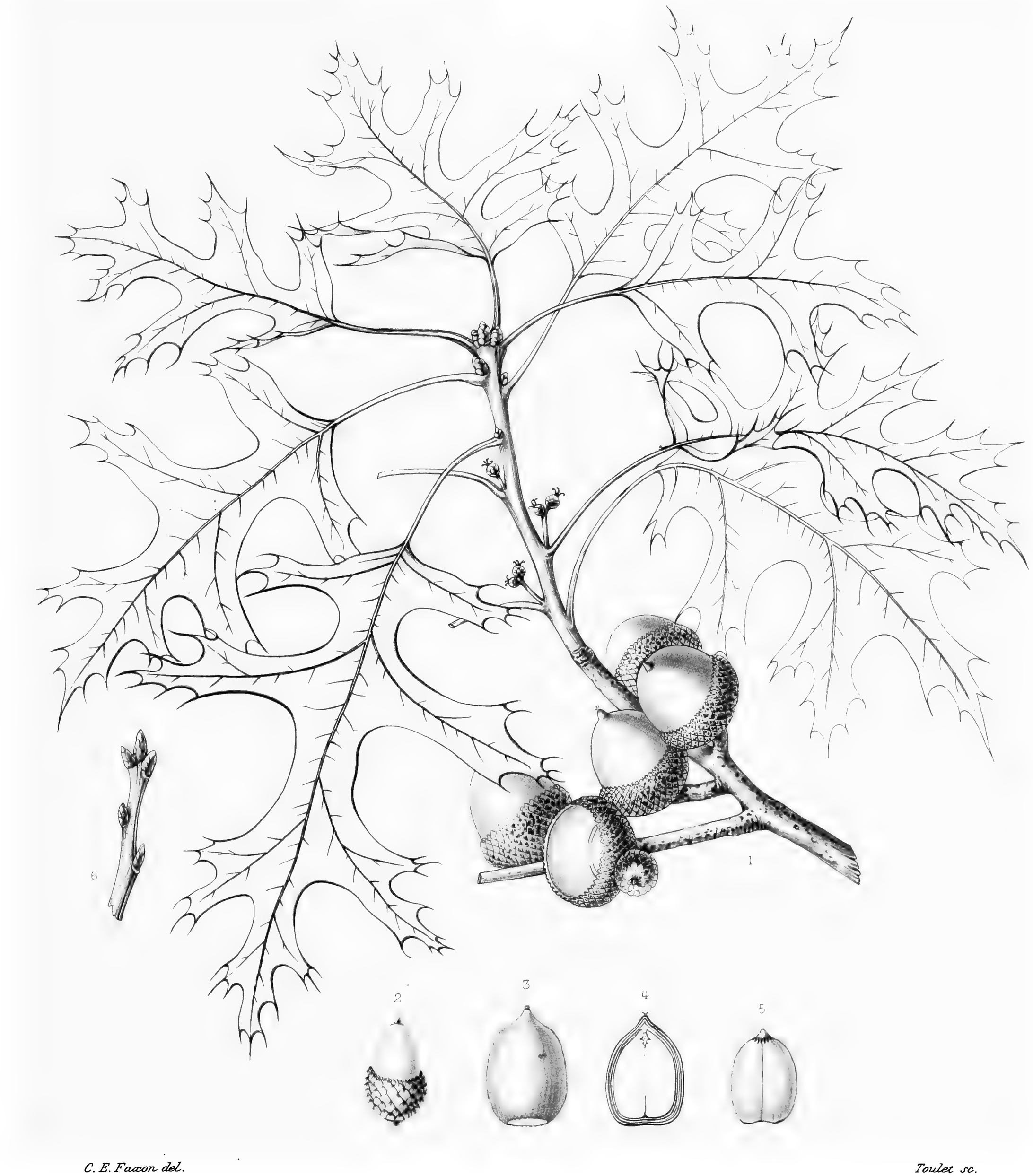
1. A fruiting branch, natural size.
2. A fruit (from Minnesota), natural size.
3. A nut (from Massachusetts), natural size.
4. Vertical section of a nut, natural size.
5. A seed, natural size.
6. A winter branchlet, natural size.



C.E.Faxon del. *Rapine sc.*

QUERCUS COCCINEA, Wang.

A.Riocreux direx.t *Imp. J.Taneur, Paris.*



C. E. Faxon del. Toulet sc.

QUERCUS COCCINEA, Wang.

A. Riocreux direx.t Imp. J. Taneur, Paris.

QUERCUS VELUTINA.

Black Oak. Yellow-bark Oak.

LEAVES ovate or obovate, slightly or deeply lobed, with broad or narrow nearly entire or dentate lobes, usually pubescent on the lower surface.

Quercus velutina, Lamarck, *Dict.* i. 721 (1783). — Koch, *Dendr.* ii. pt. ii. 68. — Lauche, *Deutsche Dendr.* 299. — Sudworth, *Rep. Sec. Agric. U. S.* 1892, 328.

Quercus nigra, Ru Roi, *Harbk. Baumz.* ii. 272 (excl. syn.), t. 6, f. 1 (not Linnæus) (1772). — Marshall, *Arbust. Am.* 120. — Wangenheim, *Nordam. Holz.* 79, t. 6, f. 16.

Quercus discolor, Aiton, *Hort. Kew.* iii. 358 (1789). — Willdenow, *Berl. Baumz.* 274; *Spec.* iv. pt. i. 444; *Enum.* 976. — Abbot & Smith, *Insects of Georgia*, ii. 111, t. 56. — Borkhausen, *Handb. Forstbot.* i. 714. — Persoon, *Syn.* ii. 569. — Poiret, *Lam. Dict.* Suppl. ii. 221. — Nuttall, *Gen.* ii. 214. — Elliott, *Sk.* ii. 601. — Sprengel, *Syst.* iii. 863. — Dietrich, *Syn.* v. 310.

Quercus tinctoria, Michaux, *Hist. Chênes Am.* No. 13, t. 24, 25 (1801); *Fl. Bor.-Am.* ii. 198. — Willdenow, *Spec.* iv. pt. i. 444; *Enum.* 976. — Persoon, *Syn.* ii. 569. — Bosc *Mém. Inst. Nat. Sci. Phys. Math.* viii. pt. i. 347. — Desfontaines *Hist. Arb.* ii. 509. — Poiret, *Lam. Dict.* Suppl. ii. 221. — Michaux f. *Hist. Arb. Am.* ii. 110, t. 22. — Pursh, *Fl. Am. Sept.* ii. 629. — Nuttall, *Gen.* ii. 214. — *Nouveau Duhamel*, vii. 170, t. 47 f. 1. — Hayne, *Dendr. Fl.* 156. — Elliott, *Sk.* ii. 601. — Sprengel, *Syst.* iii. 862. — Audubon, *Birds*, t. 82. — Hooker, *Fl. Bor.-Am.* ii. 158. — Spach, *Hist. Vég.* xi. 164. — Torrey, *Fl. N. Y.* ii. 188. — Emerson, *Trees Mass.* 141, t. 7, 8; ed. 2, i. 160, t. — Gray, *Man.* 416. — Darlington, *Fl. Cestr.* ed. 3, 268. — Morren, *Belg. Hort.* iii. 363, t. 54. — Brendel, *Trans. Ill. Agric. Soc.* iii. 627, t. 8. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 39. — Chapman, *Fl.* 422. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 45, 72, f. 18; *Liebmann Chênes Am. Trop.* 9, f. 6. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 149. — Houba, *Chênes Am. en Belgique*, 187, t.

Quercus tinctoria, α **angulosa**, Michaux, *Fl. Bor.-Am.* ii. 198 (1803). — Loudon, *Arb. Brit.* iii. 1885, f. 1753, 1754.

Quercus tinctoria, β **sinuosa**, Michaux, *Fl. Bor.-Am.* ii. 198 (1803). — Loudon, *Arb. Brit.* iii. 1885, f. 1755–1757. — Örsted, *Liebmann Chênes Am. Trop.* t. C.

? Quercus Shumardii, Buckley, *Proc. Phil. Acad.* 1860, 444.

Quercus coccinea, β **nigrescens**, A. de Candolle, *Prodr.* xvi. pt. ii. 61 (1864).

Quercus coccinea, γ **tinctoria**, A. de Candolle, *Prodr.* xvi. pt. ii. 61 (1864). — Gray, *Man.* ed. 5, 454. — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 347, t. 14. — Watson & Coulter, *Gray's Man.* ed. 6, 477.

? Quercus coccinea, δ **Rugelii**, A. de Candolle, *Prodr.* xvi. pt. ii. 62 (1864).

Quercus tinctoria, α **discolor**, Dippel, *Handb. Laubholzk.* ii. 121, f. 58 (1892).

Quercus tinctoria, β **magnifica**, Dippel, *Handb. Laubholzk.* ii. 122, f. 58 (1892).

Quercus tinctoria, γ **macrophylla**, Dippel, *Handb. Laubholzk.* ii. 123, f. 59 (1892).

Quercus tinctoria, δ **nobilis**, Dippel, *Handb. Laubholzk.* ii. 124, f. 60 (1892).

A tree, often seventy or eighty and occasionally one hundred and fifty feet in height, with a trunk three or four feet in diameter and slender branches which spread gradually into a narrow open head. The bark of the trunk is deep orange-color internally, from three quarters of an inch to an inch and a half in thickness, and is deeply divided into broad rounded ridges broken on the surface into thick dark brown or sometimes nearly black closely appressed plate-like scales; that of the young stem and the branches is smooth and dark brown. The branchlets are stout and marked with pale lenticels and coated at first with pale or fulvous scurfy tomentum which gradually disappears during the summer, and in their first winter they are dull red or reddish brown, growing dark brown in their second year or brown slightly tinged with red. The winter-buds are ovate, strongly angled, gradually narrowed and obtuse at the apex, from one quarter to nearly one half of an inch in length, and clothed with hoary tomentum. The leaves are convolute in the bud, ovate or obovate, rounded, wedge-shaped or truncate at the base, mostly seven-lobed and sometimes divided nearly to the middle by wide rounded sinuses into narrow obovate more or less repandly dentate lobes with stout rigid bristle-pointed teeth,

or into elongated nearly entire mucronate lobes tapering gradually from a broad base; or they are slightly divided into broad dentate lobes or are sinuate-dentate; the terminal lobe is oblong, elongated, acute, and furnished with large or small lateral teeth, or it is broad, generally rounded and coarsely repandly dentate; when they unfold the leaves are bright crimson, covered above with long loose scattered white hairs, and coated below with thick pale or silvery white tomentum, the lobes being tipped with tufts of long pale hairs; when half grown the leaves, like the young shoots, are hoary-pubescent, and when fully grown they are thick and firm or subcoriaceous, dark green and lustrous on the upper surface, and yellow-green, brownish or dull copper-color on the lower, which is more or less thickly clothed with close pubescence, or is sometimes tomentose, or glabrous with the exception of tufts of rusty hairs in the axils of the principal veins; usually five or six inches long and three or four inches wide, they vary from three to twelve inches in length and from two to ten inches in width, with stout midribs and primary veins raised and rounded on the upper side, slender secondary veins arcuate near the thickened revolute margins, and conspicuous reticulate veinlets; they are borne on stout yellow glabrous or puberulous petioles generally flattened on the upper side and from three to six inches long, and late in the autumn turn dull red, dark orange-color or brown, and fall gradually during the winter. The stipules are linear-obovate or linear-lanceolate, coated with pale hairs, brown and scarious, and about an inch in length. The flowers appear when the leaves are nearly half grown, the staminate borne in the axils of linear acute villous brown scarious and caducous bracts in tomentose or pubescent aments from four to six inches in length, and the pistillate on short tomentose peduncles. The calyx of the staminate flower is coated with pale hairs, and in the bud is green tinged with red and furnished at the apex with a tuft of pale hairs; the lobes are ovate acute and shorter than the stamens, which are usually four in number with ovate acute apiculate glabrous yellow anthers. The bud of the pistillate flower is bright red, coated with soft pale pubescence, and tipped by a tuft of pale hairs; the involucral scales are ovate and shorter than the acute hirsute calyx-lobes, and the stigmas are reflexed and bright red. The fruit, which ripens in the autumn of the second year, is sessile or borne on a short thick peduncle rarely more than half an inch in length, and is solitary or in pairs; the nut is ovate-oblong, obovate, oval or hemispherical, broad and rounded at the base and full and rounded at the apex which is sometimes depressed and is crowned with a short or elongated stout umbo; it is light reddish brown, often striate, frequently coated with soft rufous pubescence, and from one half to three quarters of an inch in length; the cup, which embraces about half the nut, is thin, deeply cup-shaped or turbinate, dark red-brown and puberulous on the inner surface, and covered by thin light chestnut-brown ovate acute scales clothed with hoary pubescence; at the base of the cup these are usually closely appressed, but above its middle are loosely imbricated with free scarious tips which form a fringe-like border to its rim.

Quercus velutina, which inhabits dry gravelly uplands and ridges, is distributed from the coast of southern Maine to northern Vermont, southern and western Ontario,[1] and central Minnesota,[2] and southward to northern Florida, southern Alabama and Mississippi, eastern Kansas, the Indian Territory, and eastern Texas. One of the commonest species on the gravelly drift of the southern New England and Middle States, and in the foothill regions of the southern Appalachian Mountains, where it sometimes forms a large part of the forest-growth, it is also abundant in all parts of the Mississippi basin, probably growing to its largest size in the valley of the lower Ohio River.[3] It is the only species of the Red Oak group which reaches the south Atlantic and Gulf coasts, where, although not common and never gregarious, it is generally scattered on dry ridges through the maritime Pine belt.

The wood of *Quercus velutina* is heavy, hard, and strong, although not tough, coarse-grained, and liable to check in drying; it is bright brown tinged with red, with thin lighter colored sapwood, and contains conspicuous medullary rays and broad bands of several rows of large open ducts plainly

[1] Macoun, *Cat. Can. Pl.* 443.

[2] Macmillan, *Metaspermæ of the Minnesota Valley*, 191.

[3] Ridgway, *Proc. U. S. Nat. Mus.* v. 84.

marking the layers of annual growth. The specific gravity of the absolutely dry wood is 0.7045, a cubic foot weighing 43.90 pounds.

The inner bark, which abounds in tannic acid, is largely used in tanning;[1] it furnishes a yellow dye, and medicinally is sometimes employed, in the form of decoctions, as an astringent and in external applications.[2]

According to Aiton,[3] *Quercus velutina* was introduced into English plantations in 1800. Less stately than the Red Oak, and far less beautiful in foliage, especially in autumn, than the Scarlet Oak, the Black Oak[4] is rarely planted as an ornamental tree.

None of the North American Oaks with biennial fruit vary in the form of the leaves as much as this species. The narrow-lobed leaves of some individuals are not distinguishable in outline from those of *Quercus coccinea*. It may be always recognized, however, in early spring by the deep red color of the unfolding leaves and by its pale silvery appearance a few days later at the flowering period when *Quercus coccinea* is bright green. The rusty lower surface of the mature leaves, the large tomentose winter-buds, the dark color of the outer and the deep orange-color of the inner bark, and the generally more loosely imbricated cup-scales also serve to distinguish the Black Oak from the Scarlet Oak, although the latter especially in Minnesota often produces fruit with comparatively loosely imbricated cup-scales.

[1] Porcher, *Resources of Southern Fields and Forests*, 238. — Trimble, *The Tannins*, 31, f. 20, 21.

[2] Hayne, *Arzn.* xii. 46, t. 46. — Griffith, *Med. Bot.* 586. — Guibourt, *Hist. Drog.* ed. 7, ii. 288. — *Nat. Dispens.* ed. 2, 1196. — Bentley & Trimen, *Med. Pl.* iv. 251, t. 251. — *U. S. Dispens.* ed. 16, 1261.

[3] *Hort. Kew.* ed. 2, v. 291. — Loudon, *Arb. Brit.* iii. 1884.

[4] The Black Oak is sometimes also called Quercitron Oak and Yellow Oak.

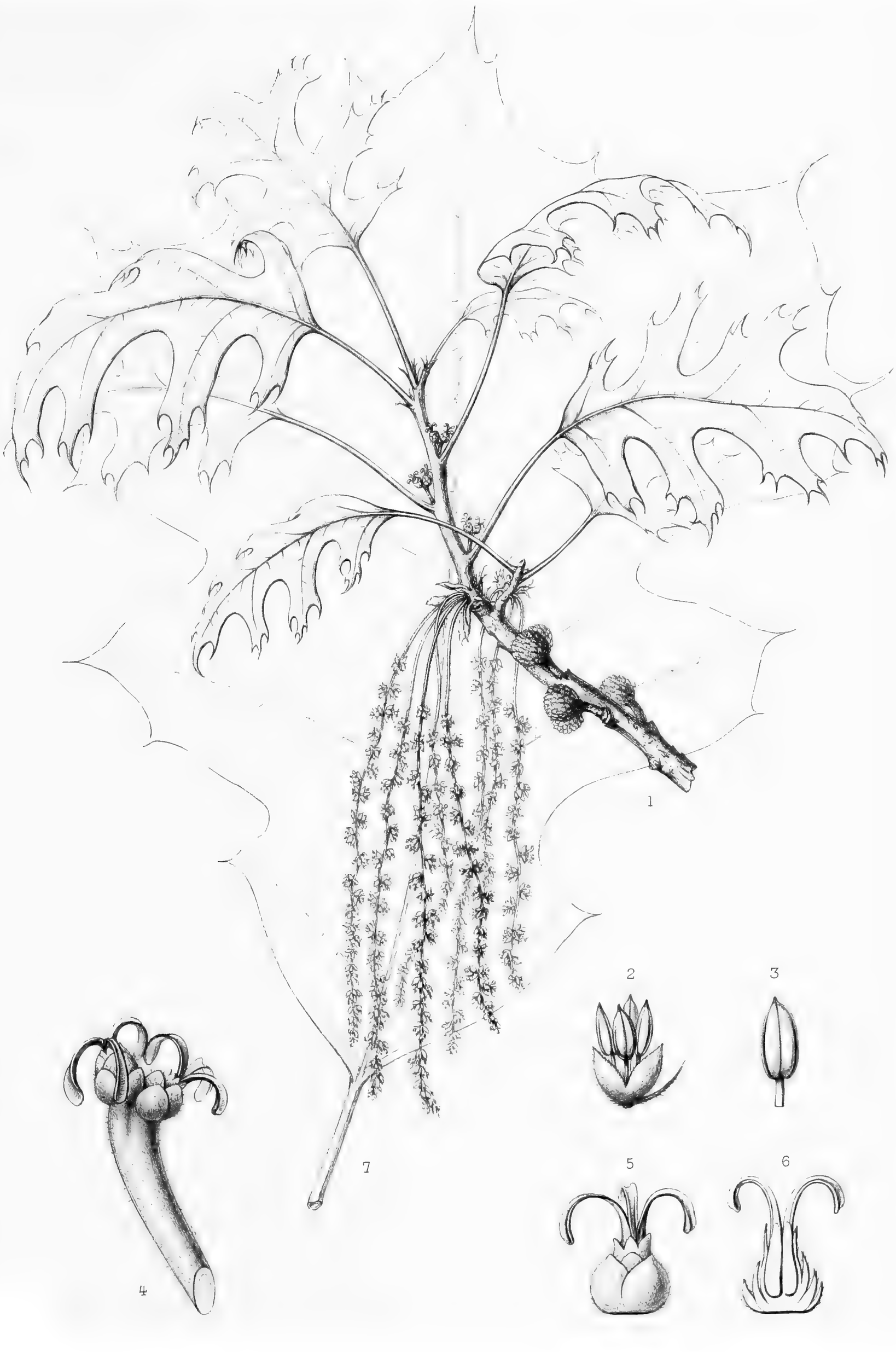
EXPLANATION OF THE PLATES.

PLATE CCCCXIV. QUERCUS VELUTINA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A stamen, enlarged.
4. A pistillate inflorescence, enlarged.
5. A pistillate flower, enlarged.
6. Vertical section of a pistillate flower, enlarged.

PLATE CCCCXV. QUERCUS VELUTINA.

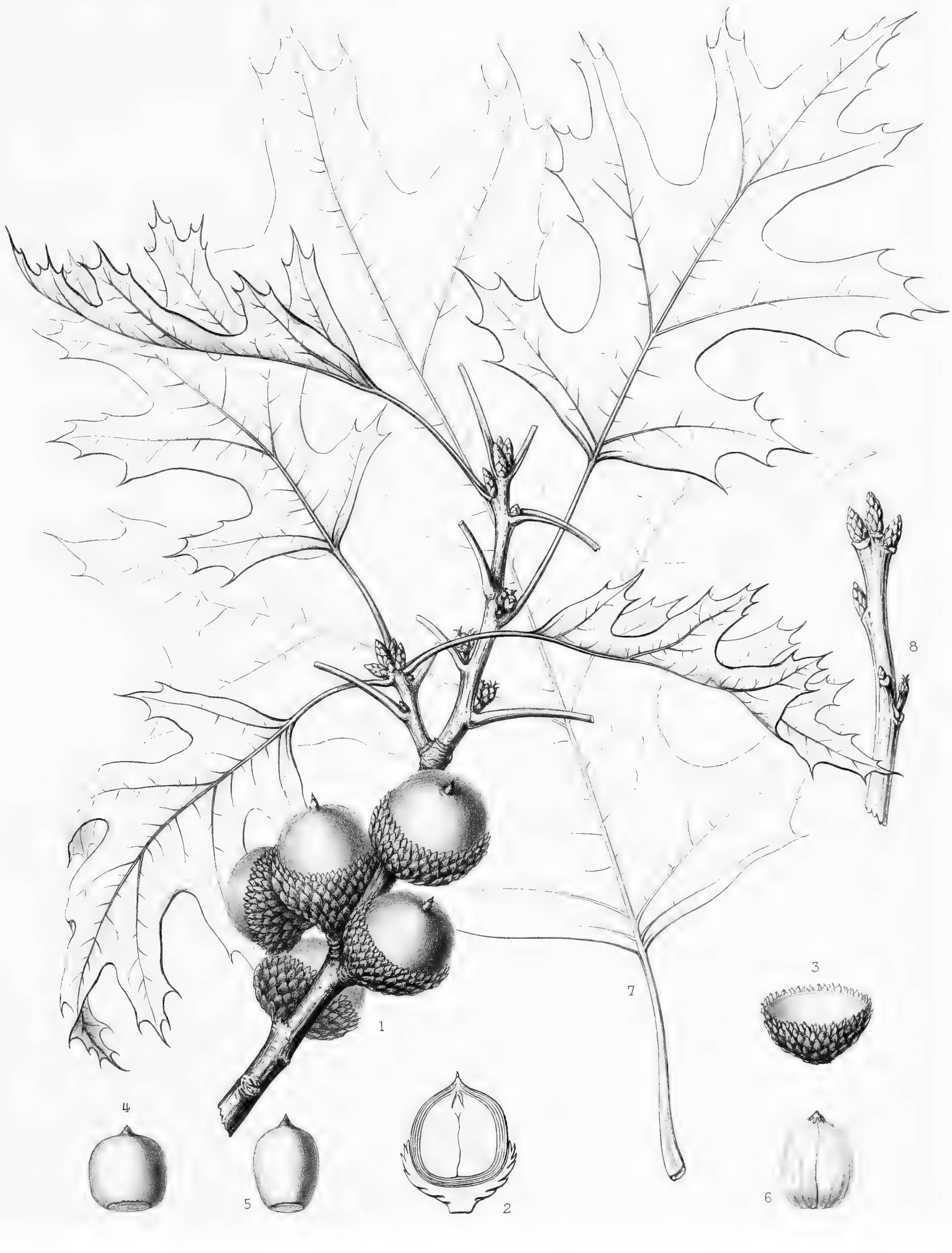
1. A fruiting branch, natural size.
2. Vertical section of a fruit, natural size.
3. A cup, natural size.
4. A nut, natural size.
5. A nut, natural size.
6. A seed, natural size.
7. A leaf, natural size.
8. A winter branchlet, natural size.



C.E. Faxon del. *Rapine sc.*

QUERCUS VELUTINA, Lam.

A. Riocreux direct. *Imp. J. Taneur, Paris.*



C.E.Faxon del. *Rapine sc.*

QUERCUS VELUTINA, Lam.

A.Riocreux direx.t *Imp. J.Taneur, Paris.*

QUERCUS CALIFORNICA.

Black Oak.

LEAVES oblong or obovate, glabrous or pubescent on the lower surface, pinnatifid-lobed, the lobes tapering and acute or broad and obovate, repand-dentate or entire.

Quercus Californica, Cooper, *Smithsonian Rep.* 1858, 261 (1859). — Sudworth, *Garden and Forest*, v. 98. — Coville, *Contrib. U. S. Nat. Herb.* iv. 196 (*Bot. Death Valley Exped.*).

Quercus tinctoria, var. **Californica**, Torrey, *Pacific R. R. Rep.* iv. pt. i. 138 (1856); *Bot. Mex. Bound. Surv.* 205; *Ives' Rep.* 28.

Quercus rubra, Bentham, *Pl. Hartweg.* 337 (not Linnæus) (1857).

Quercus Kelloggii, Newberry, *Pacific R. R. Rep.* vi. 28, f. 6; 89 (1857). — Torrey, *Bot. Wilkes Explor. Exped.* 463. — R. Brown Campst. *Horæ Sylvanæ*, 58, f. 4–6. — Engelmann, *Brewer & Watson Bot. Cal.* ii. 99. — Kellogg, *Forest Trees of California*, 83. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 149. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 215. — Greene, *West Am. Oaks*, 1, t. 1; *Man. Bot. Bay Region*, 303. — Mayr, *Wald. Nordam.* 282, t. 2. — Dippel, *Handb. Laubholzk.* ii. 117. — Koehne, *Deutsche Dendr.* 132. — Merriam, *North American Fauna*, No. 7, 334 (*Death Valley Exped.* ii.). — S. B. Parish, *Zoë*, iv. 346.

Quercus Sonomensis, A. de Candolle, *Prodr.* xvi. pt. ii. 62 (1864). — Bolander, *Proc. Cal. Acad.* iii. 230. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 72. — Engelmann, *Rothrock Wheeler's Rep.* vi. 374.

A tree, occasionally one hundred feet in height, with a trunk three or four feet in diameter and stout spreading branches which form an open round-topped head; frequently much smaller, and at high elevations reduced to a small shrub. The bark of the trunk is from an inch to an inch and a half in thickness, dark brown slightly tinged with red or nearly black, divided into broad ridges at the base of old trees, and broken above into thick irregular oblong plates covered with minute closely appressed scales; that of the young stems and the branches is smooth and light brown. The branchlets are stout and marked with minute pale lenticels and are coated at first with thick hoary tomentum which soon begins to disappear; during their first winter they are rather bright red or brown tinged with red and usually glabrous, but sometimes pubescent or puberulous or covered with a glaucous bloom, and grow dark red-brown in their second year. The winter-buds are ovate, gradually narrowed and acute at the apex, about a quarter of an inch long, and covered by closely imbricated pale chestnut-brown scales ciliate on the thin scarious margins with pale hairs and pubescent toward the point of the bud. The leaves are convolute in vernation, oblong or obovate, truncate, wedge-shaped or rounded at the narrow base, seven or rarely five-lobed by wide and deep or shallow and oblique sinuses rounded at the bottom; the terminal lobe is ovate, three-toothed at the apex with acute bristle-pointed teeth, and the lateral lobes, the central pair of which is usually much larger than the others, taper gradually from the base or are broad and obovate, and are coarsely repand-dentate with acute pointed teeth, or sometimes entire; when they unfold the leaves are dark red or purple, and pilose on the upper surface, and coated on the lower and on the petioles with thick silvery white tomentum, and when half grown are light green, stellate-pubescent above and pubescent or tomentose below; at maturity they are thick and firm, lustrous, dark yellow-green and glabrous or rarely stellate-pubescent above, and light yellow-green or brownish and glabrous or pubescent below; or, on occasional individual trees, the mature leaves and their petioles are covered with hoary pubescence; they are from three to six inches long and from two to four inches wide, and, borne on slender nearly terete yellow petioles from one to two inches in length, turn yellow or brown in the autumn before falling. The stipules are oblong-lanceolate to linear-lanceolate, brown and scarious, about three quarters of an inch long, and caducous. The flowers appear in April and May when the leaves are about half grown, the staminate borne in hairy aments four or five

inches in length, and the pistillate on short tomentose peduncles. The calyx of the staminate flower is pubescent and divided into four or five broadly ovate acute segments shorter than the stamens, which are four or five in number, with ovate acute apiculate glabrous anthers bright red when the flowers open and afterward yellow. The involucral scales of the pistillate flower are ovate, and, like the acute calyx-lobes, are coated with pale tomentum; the stigmas are recurved and dark red. The fruit, which ripens in the autumn of the second season, is usually borne on a stout peduncle rarely more than half an inch long, and is solitary or clustered; the nut is oblong, oval or obovate, broad and rounded at the base, full and rounded or gradually narrowed and acute at the puberulous apex, from an inch to an inch and a half long, about three quarters of an inch broad, light chestnut-brown and often striate with dark longitudinal bands; the thin shell is lined with a thick coat of pale ferrugineous tomentum and the astringent seed is covered by a dark red-brown coat; the cup, which embraces from one quarter to nearly two thirds of the nut, is cup-shaped, light brown and puberulous on the inner surface, and covered by thin ovate-lanceolate lustrous light chestnut-brown scales, which are sometimes rounded and thickened on the back toward the base of the cup; their tips are elongated, thin and erose on the margins, and often form a narrow fringe-like border to the rim of the cup.

An inhabitant of valleys and mountain-slopes, *Quercus Californica* is distributed from the basin of the Mackenzie River in western Oregon southward through the California coast mountains and along the western slopes of the Sierra Nevada, which it sometimes ascends to elevations of from seven to eight thousand feet, and the San Bernardino and San Jacinto Mountains, finding its southern home on the Cuyamaca Mountains near the southern boundary of California. Comparatively rare in the immediate neighborhood of the California coast, *Quercus Californica* is the largest and most abundant Oak-tree of the valleys of southwestern Oregon and of the Sierra Nevada, where it is often found scattered through the coniferous forests, sometimes forming groves of considerable extent, and growing to its largest size at elevations of about six thousand feet above the sea-level.

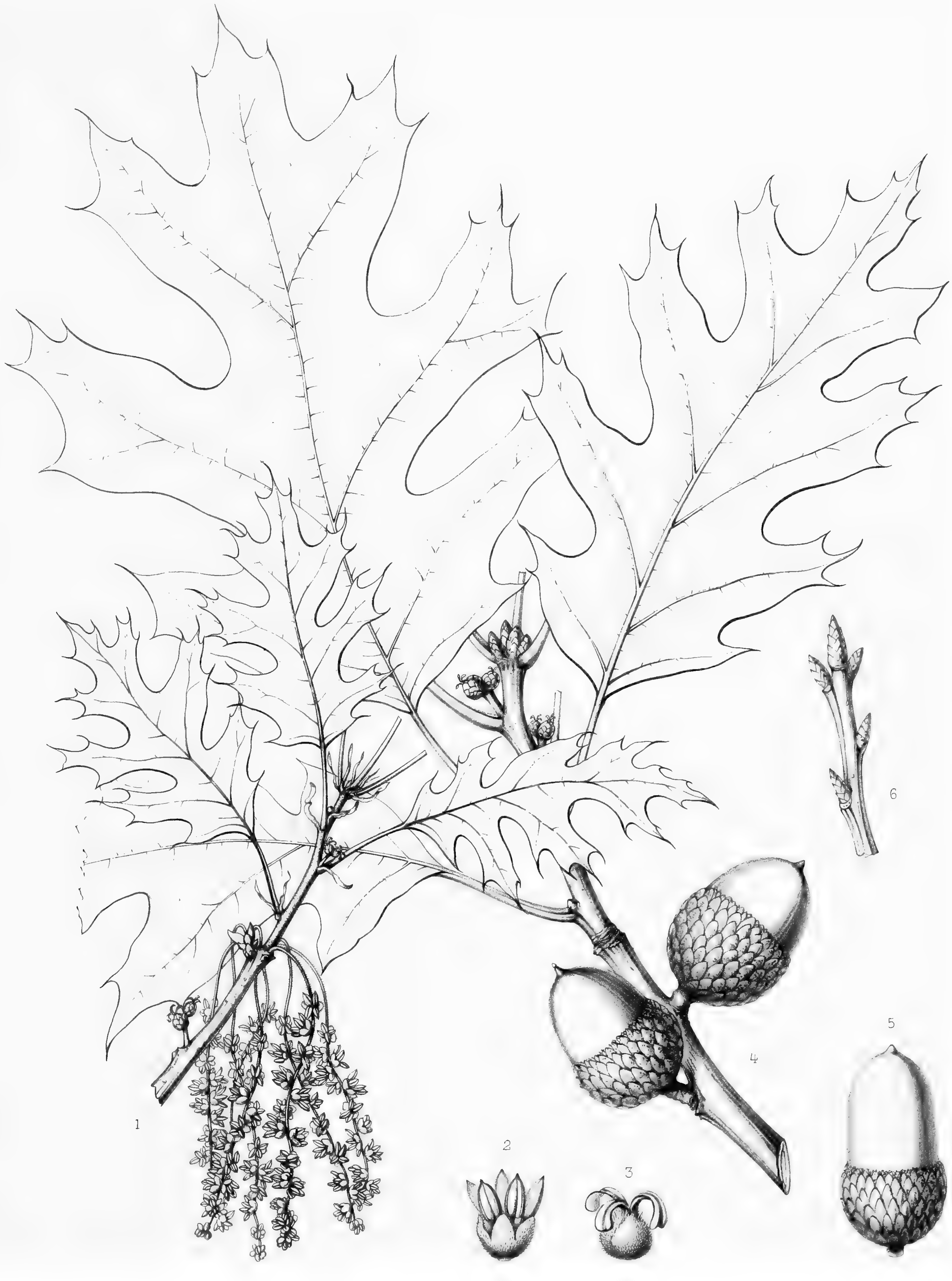
The wood of *Quercus Californica* is heavy, hard, and strong, although very brittle; it is light red, with thin lighter colored sapwood, and contains broad remote medullary rays and broad bands of several rows of large open ducts conspicuously marking the layers of annual growth. The specific gravity of the absolutely dry wood is 0.6435, a cubic foot weighing 40.10 pounds. Of little value for construction, it is sometimes used for fuel, and the bark is occasionally employed in tanning leather.

Quercus Californica was discovered in 1846 by Karl Theodore Hartweg near Sonoma, among the foothills of the California Sierras.

EXPLANATION OF THE PLATE.

PLATE CCCCXVI. QUERCUS CALIFORNICA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A fruit, natural size.
6. A winter branchlet, natural size.



C. E. Faxon del. *Migneaux sc.*

QUERCUS CALIFORNICA, Coop.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

QUERCUS CATESBÆI.

Turkey Oak.

LEAVES oblong, obovate, or triangular, glabrous, or rusty pubescent on the lower surface, deeply lobed with acute spreading often falcate lobes.

Quercus Catesbæi, Michaux, *Hist. Chênes Am.* No. 17, t. 29, 30 (1801); *Fl. Bor.-Am.* ii. 199. — Abbot & Smith, *Insects of Georgia*, i. 27, t. 14. — Willdenow, *Spec.* iv. pt. i. 446. — Persoon, *Syn.* ii. 569. — Bosc, *Mém. Inst. Nat. Sci. Phys. Math.* viii. pt. i. 348. — Desfontaines, *Hist. Arb.* ii. 511. — Poiret, *Lam. Dict.* Suppl. ii. 221. — Michaux f. *Hist. Arb. Am.* ii. 101, t. 20. — Pursh, *Fl. Am. Sept.* ii. 630. — Nuttall, *Gen.* ii. 214. — *Nouveau Duhamel*, vii. 172. — Elliott, *Sk.* ii. 603. — Sprengel, *Syst.* iii. 863. — Loudon, *Arb. Brit.* iii. 1889, f. 1762, 1763. — Spach, *Hist. Vég.* xi. 162. — Dietrich, *Syn.* v. 310. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 41. — Chapman, *Fl.* 422. — A. de Candolle, *Prodr.* xvi. pt. ii. 59. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 72. — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 344. — Koch, *Dendr.* ii. pt. ii. 67. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 151. — Houba, *Chênes Am. en Belgique*, 296, t. — Mayr, *Wald. Nordam.* 149, t. 1, 2. — Dippel, *Handb. Laubholzk.* ii. 114, t. 54.

A tree, usually twenty or thirty, or occasionally fifty or sixty, feet in height, with a trunk rarely exceeding two feet in diameter but generally much smaller, and stout spreading more or less contorted branches which form a narrow open irregular generally round-topped head; or sometimes shrubby in habit. The bark of the trunk is from half an inch to an inch in thickness, red internally, dark gray tinged with red on the surface, or at the base of old trunks sometimes nearly black, deeply and irregularly furrowed, and broken into small thick appressed scales. The branchlets, which are stout and marked with minute lenticels, are coated at first with ferrugineous tomentum of stellate and articulate hairs which soon begins to disappear, and when the leaves are half grown they are nearly glabrous and deep red; they are dark red in their first winter, and then gradually grow brown. The winter-buds are elongated, acute, half an inch long, and covered by light chestnut-brown scales with thin erose margins and coated, especially toward the point of the bud, with rusty pubescence. The leaves are convolute in vernation, oblong or obovate or nearly triangular in outline, gradually narrowed and wedge-shaped at the base, and deeply divided by wide rounded sinuses into three or five or rarely into seven lobes tipped with short stout bristles; the terminal lobe is ovate, much elongated, and acute and entire or repand-dentate toward the apex, or it is obovate and coarsely equally or irregularly three-toothed at the apex; the lateral lobes are spreading, usually falcate, entire and acute, and taper regularly from their broad bases, or they are broad and oblique and repand-lobulate at the apex; or the leaves are three-toothed at the broad apex and gradually narrowed to the base, or individual leaves are often slightly undulate-lobed or pinnatifid with oblique acute lobes; when they unfold the leaves are coated with rufous articulate hairs which slowly disappear, and when they are fully grown they are thick and rigid, bright yellow-green and lustrous on the upper surface, and paler, lustrous, and glabrous, with the exception of large tufts of rusty hairs in the axils of the veins, on the lower surface, which, however, is often covered with scurfy ferrugineous pubescence; generally about five inches long and broad, they vary from three to twelve inches in length and from one to ten inches in width, with broad yellow or red-brown midribs and primary veins raised and rounded on the upper side, prominent secondary veins arcuate and united near the slightly thickened margins, and coarse reticulate veinlets; they are borne on stout flattened grooved petioles from a quarter of an inch to nearly an inch in length, and turn brown or dull yellow before falling in the autumn. The stipules are coated with rusty tomentum, about an inch long, oblong-obovate, and are gradually narrowed into stalk-like

bases, or those of the last leaves are linear-lanceolate. The flowers open in March and April, when the leaves are about half grown, the staminate borne in the axils of linear-lanceolate hairy caducous bracts on slender hairy red-stemmed aments from four to five inches in length, and the pistillate on short stout tomentose peduncles. The calyx of the staminate flower is puberulous and divided into four or five ovate acute lobes shorter than the stamens, which are four or five in number, with oblong apiculate yellow anthers. The involucral scales of the pistillate flowers are bright red, pubescent, and hairy at the margins with long rusty hairs; the elongated reflexed stigmas are darker red. The fruit, which ripens in the autumn of the second year, is usually solitary and is borne on a stout peduncle marked with pale lenticels and rarely more than a quarter of an inch long. The nut is oval, full and rounded at both ends, about an inch in length and three quarters of an inch in breadth, dull light brown, and covered at the apex with a thin coat of snow-white tomentum; the cup, which embraces about a third of the nut, is thin, turbinate, and often gradually narrowed into a stout stalk-like base; it is light red-brown, lustrous and puberulous on the inner surface, and covered by ovate-oblong rounded scales which extend over the rim and down over the upper third of the inner surface; and are coated with dense hairy pubescence, except along their thin bright red margins.

Quercus Catesbœi inhabits dry barren sandy ridges and sandy bluffs and hummocks in the neighborhood of the coast from North Carolina to Cape Malabar and the shores of Pease Creek in Florida, and to eastern Louisiana. Comparatively rare toward the western limits of its range, it is most abundant and grows to its largest size on the high bluff-like shores of bays and estuaries in South Carolina and Georgia.

Individual trees supposed to be hybrids between *Quercus Catesbœi* and *Quercus nigra* have been observed on the coast of South Carolina,[1] and Dr. J. H. Mellichamp[2] has found in the same region another tree[3] which is supposed to be a hybrid between *Quercus Catesbœi* and *Quercus laurifolia*.

[1] *Quercus Catesbœi* × *nigra*.

Quercus Catesbœi × *aquatica*, Engelmann, *Trans. St. Louis Acad.* iii. 400 (1877).

? Quercus nigra, γ *sinuata*, Lamarck, *Dict.* i. 721 (1783).

Quercus sinuata, Walter, *Fl. Car.* 235 (1788). — A. de Candolle, *Prodr.* xvi. pt. ii. 74.

A tree, about forty feet high, found by Dr. J. H. Mellichamp many years ago growing on a sandy ridge near Bluffton, South Carolina, with *Quercus Catesbœi*, *Quercus digitata*, and *Quercus Virginiana*, and in the neighborhood of *Quercus nigra* and *Quercus brevifolia*, and now destroyed, was believed by Dr. Engelmann to be a hybrid between the Turkey and the Water Oaks and identical with the *Quercus sinuata* of Walter (Plate ccccxviii.). The leaves varied from oblong to obovate or nearly rhombic; they were gradually narrowed and wedge-shaped at the base, and acute at the apex, with sinuate shallow obtuse lobes, or sometimes they were dentate-lobed with spreading acute bristle-pointed lobes; when they unfolded they were covered, especially below, with rusty articulate hairs, and at maturity were thick and firm, dark green and lustrous above, pale and glaucous below, with the exception of tufts of dark hairs in the axils of the primary veins, from four to six inches in length and from half an inch to three inches in width. The fruit was sessile or very short-stalked, with an oval nut full and rounded at the apex, about two thirds of an inch long, and inclosed for one third of its length in the thin hemispherical turbinate cup covered by thin ovate oblong scales rounded at the broad apex and coated with pale pubescence. In the winter-buds, the color of the branchlets, and the articulate hairs of the young leaves, this tree resembled *Quercus Catesbœi*, but the thin cup of the fruit without the scales turning down into the interior, which are so marked in that species, indicates a cross with some other, either *Quercus nigra* or, as Mr. Ravenel believed, *Quercus brevifolia*.

[2] Joseph Hinson Mellichamp, the son of the Reverend Stiles Mellichamp, who for many years was preceptor of Beaufort College and afterwards pastor of St. James' Church on James Island near Charleston, and of Sarah Cromwell of Charleston, was born in St. Luke's Parish, South Carolina, on the 9th of May, 1829. A large part of his boyhood was passed in Beaufort, and at this time he imbibed from his father, who was a lover of the woods and fields, that taste for botany which he has never lost. He was graduated from the South Carolina College in 1849 and from the Medical College of Charleston in 1852, and then established himself as a physician at Bluffton, South Carolina, where he has since resided, except during the War of Secession, when he served as surgeon in the army hospitals of his native state. Absorbed in the cares and anxieties of a large professional practice in a region of scattered population and bad roads, Dr. Mellichamp has been able to render his correspondents substantial assistance by his patient and critical study of the flora of a region particularly rich in interesting plants. A keen observer and tireless collector, with no desire beyond that of increasing knowledge, he has done a real service to science through the aid he has given other students, and I am glad to take this opportunity to acknowledge my indebtedness to him for the assistance he has rendered me by studying the trees, and especially the Oaks, of the Carolina coast region.

Mellichampia, a genus of Mexican Milkweeds, was dedicated to him by Asa Gray.

[3] *Quercus Catesbœi* × *laurifolia*, Engelmann, *Trans. St. Louis Acad.* iii. 539 (1877).

The wood of *Quercus Catesbœi* is heavy, hard, strong, and rather close-grained; it is light brown tinged with red, with thick lighter colored sapwood, and contains broad bands of several rows of large open ducts marking the layers of annual growth, and many smaller ducts arranged in short lines parallel to the broad conspicuous medullary rays. The specific gravity of the absolutely dry wood is 0.7294, a cubic foot weighing 45.45 pounds. It is largely used for fuel.

Quercus Catesbœi appears to have been first described by the naturalist whose name it bears in his *Natural History of Carolina*, published in 1731.[1]

As an ornamental tree the Turkey Oak[2] has little to commend it, and it is chiefly valuable from its ability to grow rapidly and produce good fuel on barren soil.

This tree (Plate ccccxix.), which is about forty feet high, grows in the town of Bluffton close to a tree of *Quercus laurifolia*, the two, seen from a little distance, appearing identical in form and general appearance, in the color of their foliage, and in their smooth dark bark. The leaves are lanceolate to ovate or oblong-obovate; on the upper branches they are narrow and entire or slightly lobed, or sometimes pinnatifid, and on the lower branches are broader and usually furnished with one or rarely with two pairs of wide-spreading sometimes falcate acute entire lobes; or some leaves are broadly obovate, undulate, and three-lobed at the ends; when they unfold they are pubescent below and fulvous-glandular but soon glabrate above; and at maturity they are conspicuously reticulate-venulose, dark green and lustrous on the upper surface, and yellow and orange-color on the under surface, which is glabrous or slightly puberulous. On the lower branches they are sometimes six or seven inches long and three or four inches wide, while on the upper they vary from two to five inches in length and from one to two inches in width. The fruit is sessile or short-stalked, with a subglobose nut three quarters of an inch long and inclosed for about a quarter of its length in a thin cup-shaped cup covered by ovate acute or truncate scales coated with pale pubescence. In the winter-buds, although rather smaller and more glabrous, this tree resembles *Quercus Catesbœi*, but the thin cup-shaped cups indicate a cross with some other species, probably *Quercus laurifolia*, which it also resembles in the leaves on its upper branches.

[1] *Quercus Esculi divisura foliis amplioribus aculeatis*, i. 23, t. 23 (not Plukenet).

[2] The Turkey Oak is also called Scrub Oak, Black Jack, and Fork-leaved Black Jack.

EXPLANATION OF THE PLATES.

Plate CCCCXVII. Quercus Catesbæi.

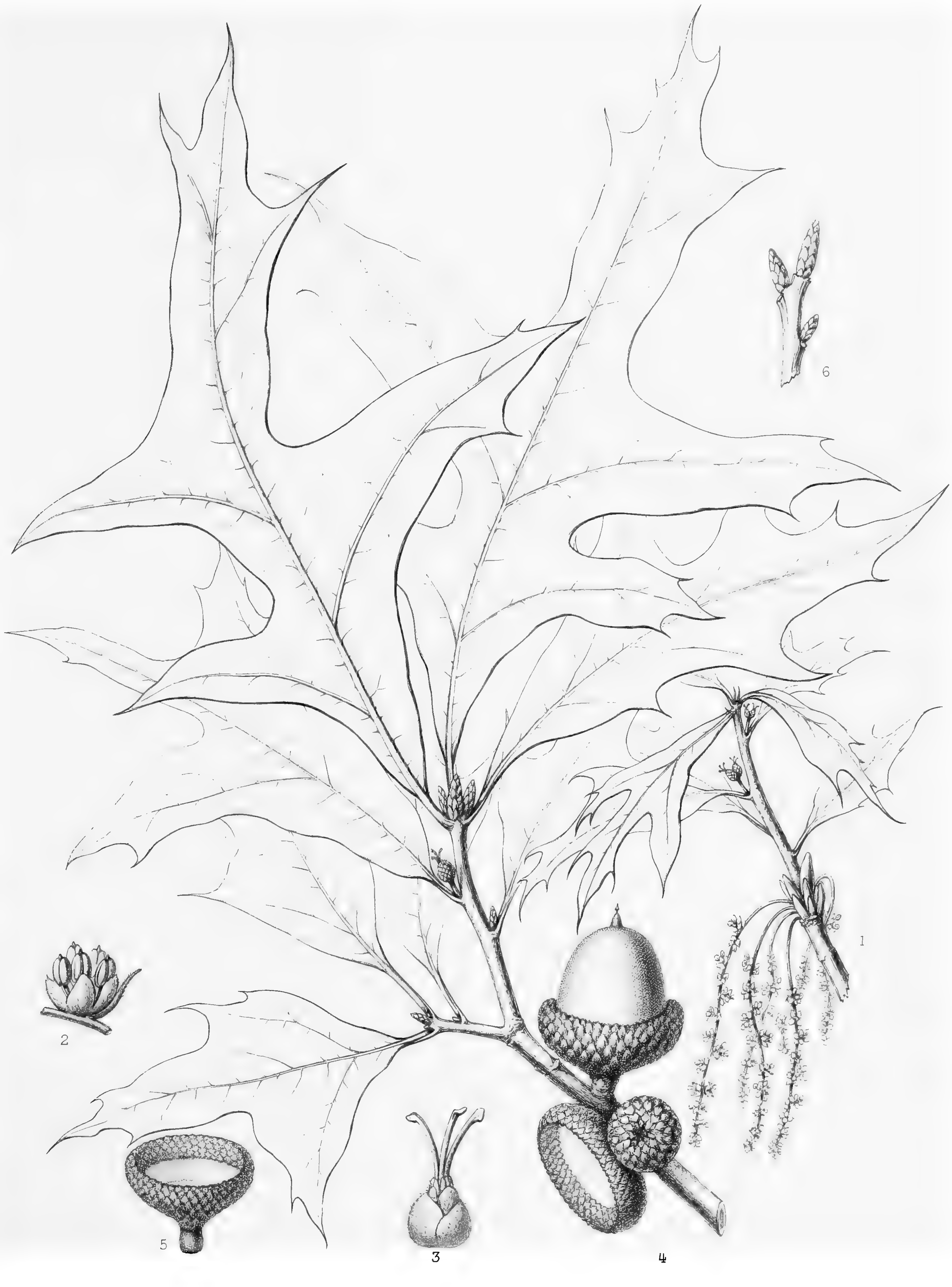
1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A cup, natural size.
6. A winter branchlet, natural size.

Plate CCCCXVIII. Quercus Catesbæi × nigra (Quercus sinuata).

1. A fruiting branch, natural size.
2. End of a sterile branch, natural size.

Plate CCCCXIX. Quercus Catesbæi × laurifolia.

1. A fruiting branch, natural size.
2. A sterile branch with narrow acutely lobed leaves.
3. A large leaf like the leaf of *Quercus Catesbæi*, from one of the lower branches.
4. A lanceolate entire leaf like the leaf of *Quercus laurifolia*, from the upper part of the tree.



C.E. Faxon del.

Rapine sc.

QUERCUS CATESBÆI, Michx.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

C.E. Faxon del.

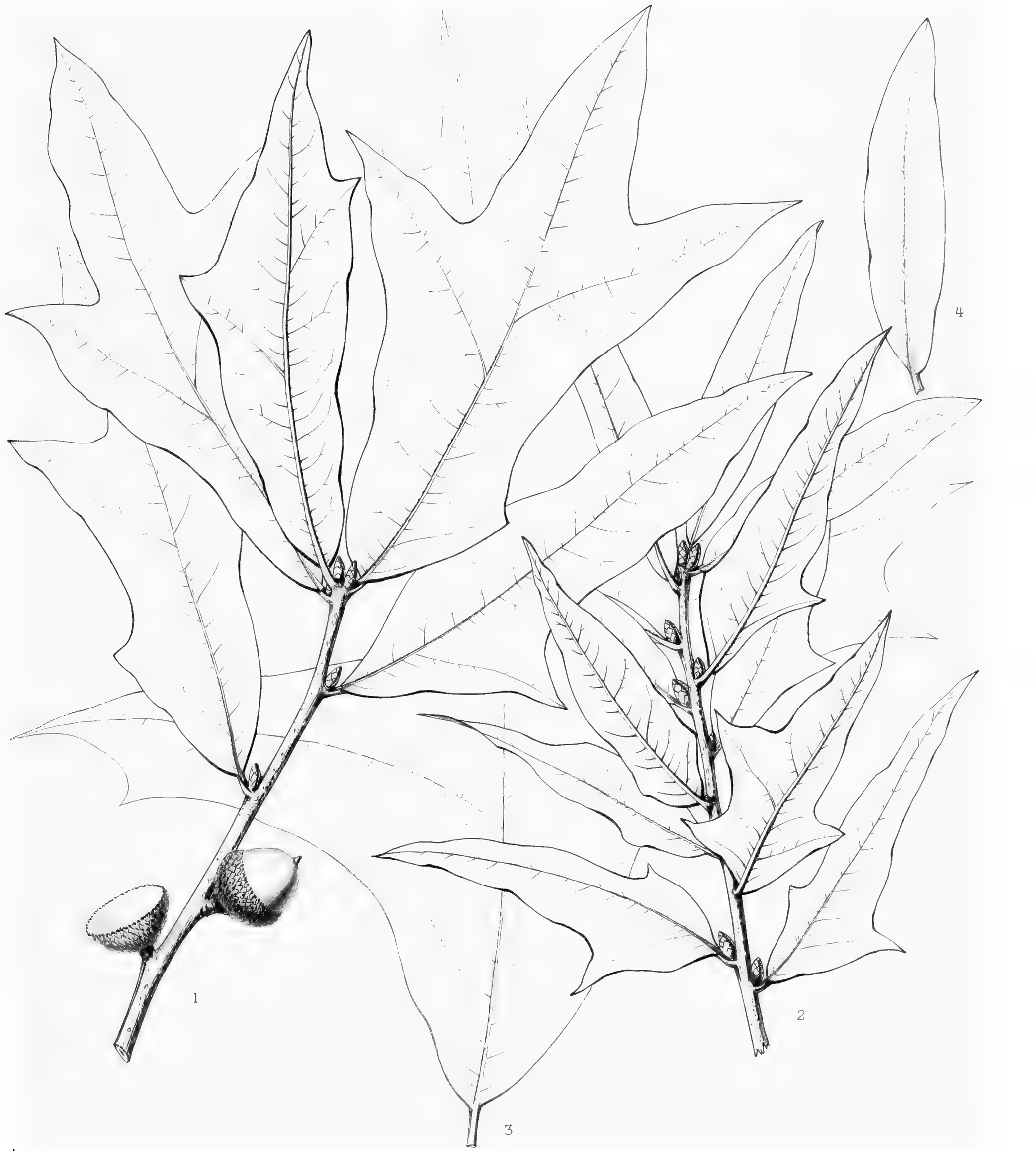
Himely sc.

QUERCUS CATESBÆI x NIGRA

(QUERCUS SINUATA , Walt.)

A. Riocreux direct.t

Imp. J. Taneur, Paris



C.E. Faxon del. *Himely sc.*

QUERCUS CATESBÆI x LAURIFOLIA.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

QUERCUS DIGITATA.

Spanish Oak.

LEAVES oblong or obovate, 3 to 5-lobed, the lobes usually elongated and falcate, fulvous or pale-pubescent on the lower surface.

Quercus digitata, Sudworth, *Garden and Forest*, v. 98 (1892); *Rep. Sec. Agric. U. S.* 1892, 328. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 417 (*Man. Pl. W. Texas*).

Quercus nigra digitata, Marshall, *Arbust. Am.* 121 (1785).

? Quercus rubra montana, Marshall, *Arbust. Am.* 123 (1785).

Quercus cuneata, Wangenheim, *Nordam. Holz.* 78, t. 5, f. 14 (1787). — Koch, *Dendr.* ii. pt. ii. 64. — Lauche, *Deutsche Dendr.* 296. — Dippel, *Handb. Laubholzk.* ii. 111, f. 52, 53. — Koehne, *Deutsche Dendr.* 132.

Quercus rubra, *β* **Hispanica**, Castiglioni, *Viag. negli Stati Uniti*, ii. 347 (excl. syn.) (1790).

Quercus rubra, *β*, Abbot & Smith, *Insects of Georgia*, i. 27, t. 14 (1797).

Quercus rubra, Abbot & Smith, *Insects of Georgia*, i. 99, t. 50 (not Linnæus) (1797).

Quercus falcata, Michaux, *Hist. Chênes Am.* No. 16, t. 28 (1801); *Fl. Bor.-Am.* ii. 199. — Persoon, *Syn.* ii. 569. — Poiret, *Lam. Dict.* Suppl. ii. 221. — Michaux f. *Hist. Arb. Am.* ii. 104, t. 21. — Pursh, *Fl. Am. Sept.* ii. 631. — Nuttall, *Gen.* ii. 214. — *Nouveau Duhamel*, vii. 169. — Elliott, *Sk.* ii. 604. — Darlington, *Fl. Cestr.* ed. 3, 269. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 39. — Chapman, *Fl.* 422. — A. de Candolle, *Prodr.* xvi. pt. ii. 58. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 72; *Liebmann Chênes Am. Trop.* t. A, t. 22, f. 3. — Wesmael, *Bull. Féd. Hort. Soc. Belg.* 1869, 342. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 150. — Houba, *Chênes Am. en Belgique*, 243, t. — Watson & Coulter, *Gray's Man.* ed. 6, 478. — Mayr, *Wald. Nordam.* 148, t. 2.

Quercus triloba, Michaux, *Hist. Chênes Am.* No. 14, t. 26 (1801). — Willdenow, *Spec.* iv. pt. i. 443; *Berl. Baumz.* ed. 2, 341. — Persoon, *Syn.* ii. 569. — Bosc, *Mém. Inst. Nat. Sci. Phys. Math.* viii. pt. i. 348. — Poiret, *Lam. Dict.* Suppl. ii. 220. — Aiton, *Hort. Kew.* ed. 2, v. 291. — Pursh, *Fl. Am. Sept.* ii. 628. — Hayne, *Dendr. Fl.* 156. — Sprengel, *Syst.* iii. 862. — Dietrich, *Syn.* v. 310.

Quercus elongata, Willdenow, *Muehlenberg & Willdenow Neue Schrift. Gesell. Nat. Fr. Berlin*, iii. 400 (1801); *Spec.* iv. pt. i. 444.

Quercus falcata, *β* **triloba**, Nuttall, *Gen.* ii. 214 (1818). — Elliott, *Sk.* ii. 604. — A. de Candolle, *Prodr.* xvi. pt. ii. 59. — Wesmael, *Bull. Féd. Hort. Soc. Belg.* 1869, 343.

Quercus falcata, var. b **pagodæfolia**, Elliott, *Sk.* ii. 605 (1824). — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 39.

Quercus discolor, Spach, *Hist. Vég.* xi. 163 (not Aiton) (1842).

Quercus falcata, *β* **Ludoviciana**, A. de Candolle, *Prodr.* xvi. pt. ii. 59 (1864).

A tree, usually seventy or eighty feet tall, with a trunk from two to three feet in diameter and stout spreading branches which form a broad round-topped open head, but occasionally growing to a height of a hundred feet, with a trunk five feet in diameter. The bark of the trunk is from three quarters of an inch to an inch in thickness, and is dark brown tinged with red or sometimes pale, and is divided by shallow fissures into broad ridges covered with thin rather closely appressed scales. The branchlets are stout, marked with many minute lenticels, and coated at first, as are the young leaves, with a thick rusty or orange-colored clammy tomentum of articulate hairs; during their first winter they are dark red or reddish brown, and pubescent or rarely glabrous or nearly so, and in their second year grow dark reddish brown or ashy gray. The winter-buds are ovoid or oval, acute, from an eighth to a quarter of an inch long, and are covered by bright chestnut-brown puberulous or pilose scales often ciliate with short pale hairs. The leaves are convolute in the bud, oblong or obovate in outline, and generally narrowed and wedge-shaped or abruptly wedge-shaped, or rounded and slightly narrowed at the base; in one form they are divided by deep wide oblique sinuses rounded at the bottom into three, five, or seven bristle-pointed lobes; the terminal lobe is then usually much elongated, often scythe-shaped, acute and entire or repand-dentate near the apex, with one or two large bristle-pointed teeth, and the lateral lobes are oblique or spreading and often falcate, gradually narrowed from a broad base

and acute and entire, or in five or seven-lobed leaves, those of the middle or upper pairs, which are generally the largest, are oblique and lobulate at the apex; in another form the leaves are oblong-obovate and divided at the broad apex by wide or narrow sinuses broad and rounded at the bottom into three rounded or acute entire or dentate lobes, and are entire and gradually narrowed below into an acute or rounded base; the leaves of the two forms usually occur on separate trees, although sometimes on the same branch; when they first unfold they hang closely appressed against the stem, and when fully grown they are thin and firm, dark green and lustrous on the upper surface and coated below with soft close pale or rusty pubescence; those of the first form are six or seven inches long and four or five inches wide, and those of the second vary from three to eight inches in length and from two to five inches in width; they are obscurely reticulate-venulose, with stout tomentose midribs, and primary veins which are stout when running to the points of the lobes or thinner in the entire portions of the leaf, and are then arcuate or forked within the revolute and slightly thickened margins; the leaves are borne on slender flattened petioles from one to two inches in length, and in the autumn before falling turn brown, dull orange-color, or sometimes bright clear yellow. The stipules are oblong-obovate to linear-lanceolate, brown and scarious, ciliate on the margins, especially toward the apex, and caducous. The flowers, which appear from March in the south to May at the north, open with the unfolding of the leaves, the staminate borne in the axils of acute hairy caducous bracts in tomentose aments from three to five inches in length, and the pistillate on stout tomentose peduncles. The calyx of the staminate flower is thin and scarious, pubescent on the outer surface, and divided into four or five ovate rounded segments shorter than the stamens, which are four or five in number, with oblong emarginate glabrous yellow anthers. The involucral scales of the pistillate flower are coated with rusty tomentum and are as long as the acute calyx-lobes or rather shorter; the stigmas are elongated and dark red. The fruit ripens in the autumn of the second year and is sessile or borne on a short stout peduncle rarely half an inch in length; the nut is subglobose to ellipsoidal, full and rounded at the apex, truncate and rounded at the base, about half an inch long, and rather light orange-brown; the cup, which embraces only the base or sometimes a third of the nut, is thin and saucer-shaped, and flat on the bottom or often gradually narrowed from a stalk-like base, or it is deeper and turbinate; it is bright reddish brown and puberulous on the inner surface, and covered by thin ovate-oblong reddish scales, acute or rounded at the apex and covered, except on their margins, with pale pubescence.

The Spanish Oak is distributed from southern New Jersey southward to central Florida, through the Gulf states to the valley of the Brazos River in Texas, and through Arkansas and southwestern Missouri to central Tennessee and Kentucky, and southern Illinois and Indiana. Comparatively rare in the north Atlantic states, where it is found only in the neighborhood of the coast, in the south Atlantic and Gulf states it is one of the commonest inhabitants of the forests which cover the dry hills between the coast plain and the Appalachian mountains. Much less abundant in the maritime Pine belt of the south, it there produces, more generally than in other parts of the country, the broad obovate three-lobed leaves. Although usually an inhabitant of dry gravelly uplands and sandy barrens, in the southern states from the valley of the Appalachicola River in western Florida to Arkansas, Illinois, and Indiana, the Spanish Oak occasionally inhabits the rich and often inundated bottom-lands of streams, upon which it grows to its largest size with the Sweet Gum, the Pecan, the Swamp White Oaks, the Texas Oak, the Pin Oak, and the western Shellbark Hickory.[1]

The wood of the upland tree is hard and strong, but not durable in contact with the ground,

[1] The swamp form of *Quercus digitata* is peculiar in its pale scaly bark, large buds, and oblong leaves deeply divided into from three to seven acute spreading entire or lobulate lobes. The leaves are from six to nine inches long and from four to six inches wide, and in the autumn turn bright clear yellow before falling. The cups of the fruit are frequently flat on the bottom, although turbinate cups also often occur on the same branch; the scales are rather more loosely imbricated with darker margins than those of upland trees. Little is yet known of the character and structure of the wood produced by this swamp tree, but by lumbermen it is considered almost as valuable as that of the White Oak (Ridgway, *Proc. U. S. Nat. Mus.* v. 80; xvii. 413. — *Garden and Forest*, viii. 101, f. 16).

coarse-grained, and liable to check badly in drying; it is light red, with thick lighter colored sapwood, and contains remote conspicuous medullary rays and bands of several rows of large open ducts marking the layers of annual growth. The specific gravity of the absolutely dry wood is 0.6928, a cubic foot weighing 43.17 pounds. It is sometimes used in construction and largely as fuel. The bark is rich in tannin and is employed with that of other species in tanning leather,[1] and sometimes medicinally in domestic practice in the form of decoctions.[2]

The Spanish Oak was mentioned by Kalm [3] in the account of his travels in North America during the middle of the last century, and appears to have been first described in the second edition of Clayton's *Flora Virginica*, published in 1762.[4] A year later, according to Aiton,[5] it was introduced into English plantations.

The Spanish Oak is one of the most distinct of the Black Oaks of North America which bear lobed leaves, and, in spite of the various forms its leaves assume, it may always be easily recognized by their drooping habit and the peculiar rusty covering of their lower surface. Their ample size, curious forms, and distinct coloring make the Spanish Oak a conspicuous and a most desirable ornamental tree, and it is often used to shade houses and village streets in the upper districts of the south Atlantic and Gulf states, where noble old specimens may often be seen.

[1] Trimble, *The Tannins*, ii. 37, f. 23.

[2] Lindley, *Fl. Med.* 292. — Porcher, *Resources of Southern Fields and Forests*, 256.

[3] *Travels*, English ed. i. 66.

[4] *Quercus rubra seu Hispanica hic dicta, foliis amplis varie profundeque incisis. Cortex ad corium depsendum utilissimus*, 149.

[5] *Hort. Kew.* ed. 2, v. 291 (*Quercus elongata*). — Loudon, *Arb. Brit.* iii. 1882, f. 1750, 1751.

EXPLANATION OF THE PLATES.

Plate CCCCXX. Quercus digitata.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A winter branchlet, natural size.

Plate CCCCXXI. Quercus digitata.

1. A leaf, natural size.
2. A branch, natural size.
3. A leaf, natural size.
4. A fruit, natural size.
5. A fruit, natural size.
6. A fruit, natural size.
7. A fruit, natural size.

C. E. Faxon del.

Rapine sc.

QUERCUS DIGITATA, Sudw.

A. Riocreux direct.

Imp. J. Taneur, Paris.

C.E.Faxon del. Himely sc.

QUERCUS DIGITATA, Sudw.

A. Riocreux direx.t Imp. J. Taneur, Paris.

QUERCUS PALUSTRIS.

Pin Oak. Swamp Spanish Oak.

LEAVES obovate, sinuate-lobed by deep wide sinuses, the spreading lobes acute or obtuse, usually coarsely repand-dentate.

Quercus palustris, Muenchhausen, *Hausv.* v. 253 (1770). — Du Roi, *Obs.* 35; *Harbk. Baumz.* ii. 268, t. 5, f. 4. — Moench, *Bäume Weiss.* 95. — Wangenheim, *Nordam. Holz.* 76, t. 5, f. 10. — Borkhausen, *Handb. Forstbot.* i. 706. — Michaux, *Hist. Chênes Am.* No. 19, t. 33, 34; *Fl. Bor.-Am.* ii. 200. — Willdenow, *Spec.* iv. pt. i. 446; *Enum.* 976; *Berl. Baumz.* ed. 2, 343. — Persoon, *Syn.* ii. 569. — Bosc, *Mém. Inst. Nat. Sci. Phys. Math.* viii. pt. i. 349. — Desfontaines, *Hist. Arb.* ii. 511. — Poiret, *Lam. Dict.* Suppl. ii. 222. — Michaux f. *Hist. Arb. Am.* ii. 123, t. 25. — Aiton, *Hort. Kew.* ed. 2, v. 292. — Pursh, *Fl. Am. Sept.* ii. 631. — Nuttall, *Gen.* ii. 214. — *Nouveau Duhamel*, vii. 172. — Hayne, *Dendr. Fl.* 158. — Sprengel, *Syst.* iii. 863. — Loudon, *Arb. Brit.* iii. 1887, f. 1758–1761, t. — Spach, *Hist. Vég.* xi. 166. — Torrey, *Fl. N. Y.* ii. 190, t. 107. — Dietrich, *Syn.* v. 311. — Darlington, *Fl. Cestr.* ed. 3, 269. — Brendel, *Trans. Ill. Agric. Soc.* iii. 631, t. 10. — A. de Candolle, *Prodr.* xvi. pt. ii. 60. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 31, 72, f. 4; *Liebmann Chênes Am. Trop.* t. A. — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 346. — Koch, *Dendr.* ii. pt. ii. 71. — Emerson, *Trees Mass.* ed. 2, i. 167, t. — Lauche, *Deutsche Dendr.* 299. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 151. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 187. — Houba, *Chênes Am. en Belgique*, 169, t. — Watson & Coulter, *Gray's Man.* ed. 6, 478. — Mayr, *Wald. Nordam.* 148, t. 2. — Dippel, *Handb. Laubholzk.* ii. 115. — Koehne, *Deutsche Dendr.* 132.

Quercus rubra dissecta, Lamarck, *Dict.* i. 720 (1783). — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 423.

Quercus rubra ramosissima, Marshall, *Arbust. Am.* 122 (1785). — Muehlenberg & Willdenow, *Neue Schrift. Gesell. Nat. Fr. Berlin*, iii. 398.

Quercus palustris, β **cucullata**, Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 346.

A tree, usually seventy or eighty feet in height, with a trunk two or three feet in diameter, often clothed with small tough drooping branches, or, when crowded in the forest by other trees, sometimes one hundred and twenty feet high, with a clean trunk sixty or seventy feet tall and four or five feet in diameter near the ground. Until it is forty or fifty years old the slender elongated branches of the Pin Oak, which are beset with short ridged spur-like lateral branchlets a few inches in length, form a broad symmetrical pyramidal head, the lowest branches being generally shorter than those above them on the tree; as it reaches middle life the branches become rigid and more pendulous and are often covered with the small drooping branchlets characteristic of this tree, while the narrow head grows open and irregular in outline. The bark of the trunk is from three quarters of an inch to an inch and a quarter in thickness, and is light gray-brown, generally smooth and covered with small closely appressed scales; that of young trunks and the branches is smooth, lustrous, and light brown, frequently tinged with green. The branchlets are slender, very tough, and marked with minute scattered pale lenticels; they are dark red at first and covered with short pale silvery tomentum, but soon become green and glabrous, and in their first winter are lustrous, dark reddish brown or orange-color, growing darker in their second year, when they are often tinged with olive-green and ultimately are dark gray-brown. The winter-buds are ovate, gradually narrowed and acute at the apex, about an eighth of an inch long, and covered by numerous closely imbricated light chestnut-brown scales often puberulous toward the thin and sometimes ciliate margins. The leaves are convolute in the bud, obovate in outline, narrowed and wedge-shaped or broad and truncate at the base, and seven or often five-lobed by usually wide and deep but occasionally narrow shallow sinuses rounded at the bottom; the terminal lobe is ovate, acute, three-toothed toward the apex or entire, and the lateral lobes are spreading or oblique, sometimes falcate, especially the lowest pair, gradually tapering and acute at the dentate apex, or obovate and broad at the apex, particularly those of the upper or of the middle pairs which are longer than the others

and dentate-lobed, the lobes and teeth of the leaf terminating in long slender bristles; when they unfold they are light bronze-green stained with red on the margins, lustrous and puberulous on the upper surface, and coated on the lower and on the petioles with pale scurfy pubescence, and at maturity they are thin and firm, dark green and very lustrous above, pale below and furnished with large tufts of pale hairs in the axils of the primary veins, from four to six inches long and from two to four inches wide, with stout midribs broad and rounded on the upper side, conspicuous primary veins running obliquely to the points of the lobes, and thin secondary veins arcuate and united within the slightly thickened and revolute margins and connected by obscure reticulate veinlets; they are borne on slender nearly terete yellow petioles from half an inch to two inches in length, and late in the autumn turn gradually to a beautiful deep scarlet color over the entire or over only a part of their surface. The stipules, which are red and scarious but turn brown before falling, are tipped with clusters of soft white hairs, and are about half an inch in length. The flowers appear in May when the leaves are about a third grown, the staminate borne in hairy aments from two to three inches long and the pistillate on short tomentose peduncles. The calyx of the staminate flower is puberulous and divided into four or five oblong rounded segments more or less laciniately cut on the margins and shorter than the stamens, which are four or five in number, with oblong slightly emarginate glabrous yellow anthers. The involucral scales of the pistillate flower are broadly ovate, tomentose, and shorter than the acuminate calyx-lobes; the stigmas are bright red and recurved. The fruit ripens in the autumn of the second season and is sessile or short-stalked and solitary or often clustered; the nut is nearly hemispherical, about half an inch in length and somewhat less in breadth, and light brown and often striate, with a thin shell coated on the inner surface with pale ferrugineous tomentum; the cup, which embraces only the very base of the nut, is thin and shallow, saucer-shaped, dark red-brown and puberulous within, and covered by closely appressed ovate light reddish brown thin puberulous scales darkest along the margins and rounded at the ends.

Quercus palustris inhabits the borders of swamps, and river-bottoms where the surface is frequently overflowed, growing in deep moist rich soil, and is distributed from the valley of the Connecticut River, where, near Amherst, Massachusetts, it finds its eastern home,[1] to southern Missouri, and southward to the valley of the lower Potomac River in Virginia, and to central Kentucky, northern Arkansas, and the eastern borders of the Indian Territory. Rare and of small size in New England, and absent from the elevated regions of the interior, it is exceedingly common on the coast plain south of the Hudson River and in the basin of the lower Ohio River, where it grows to its largest size in the forests which cover the broad bottom-lands of the principal streams.[2]

The wood of *Quercus palustris* is heavy, hard, strong, and coarse-grained, but liable to check and warp in drying; it is light brown, with thin rather dark colored sapwood, and contains numerous broad conspicuous medullary rays and broad bands of several rows of large open ducts marking the layers of annual growth. The specific gravity of the absolutely dry wood is 0.6938, a cubic foot weighing 43.24 pounds. It is sometimes used in construction and for shingles and clapboards in the regions where this tree is common.

First described from a specimen cultivated in Germany, *Quercus palustris* has been for more than a century an inhabitant of the parks of Europe, where it often grows vigorously and attains a large size. Although less commonly planted in its native land, its symmetrical habit and the beauty of its summer and autumn foliage make it always a distinct and desirable ornamental tree, and no other Oak is better suited to shade the highways or adorn the parks of the northern states.[3]

The Pin Oak, which owes its name to the small branches which are inserted on the limbs and trunk, is easily transplanted; it grows rapidly and is hardy beyond the limits of its native home.

[1] Stone, *Bull. Torrey Bot. Club*, ix. 57.

[2] Ridgway, *Proc. U. S. Nat. Mus.* v. 83.

[3] The value of the Pin Oak for street-planting is shown by the beautiful rows of this tree in the streets of the town of Flushing, on Long Island, New York.

EXPLANATION OF THE PLATES.

Plate CCCCXXII. Quercus palustris.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate inflorescence, enlarged.
4. A pistillate flower, the involucre removed, enlarged.
5. Vertical section of a pistillate flower before fecundation, enlarged.
6. A leaf, natural size.
7. A leaf, natural size.

Plate CCCCXXIII. Quercus palustris.

1. A fruiting branch, natural size.
2. A cup, natural size.
3. A seed, natural size.
4. A winter branchlet, natural size.

C. E. Faxon del. *Himely sc.*

QUERCUS PALUSTRIS, Muench.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

C.E.Faxon del.

Himely sc.

QUERCUS PALUSTRIS, Muench.

A.Riocreux direx.t

Imp. J.Taneur, Paris.

QUERCUS NANA.

Bear Oak. Scrub Oak.

LEAVES obovate, mostly acutely 5-lobed, coated on the lower surface with pale pubescence.

Quercus nana, Sargent, *Garden and Forest*, viii. 93 (1895).

Quercus rubra nana, Marshall, *Arbust. Am.* 123 (1785). — Muehlenberg & Willdenow, *Neue Schrift. Gesell. Nat. Fr. Berlin*, iii. 401.

Quercus ilicifolia, Wangenheim, *Nordam. Holz.* 79, t. 6, f. 17 (1787). — Willdenow, *Berl. Baumz.* 275; *Spec.* iv. pt. i. 447; *Enum.* 977. — Borkhausen, *Handb. Forstbot.* ii. 1504. — Persoon, *Syn.* ii. 569. — Bigelow, *Fl. Boston.* 228. — Nuttall, *Gen.* ii. 215. — Elliott, *Sk.* ii. 605. — Guimpel, Otto & Hayne, *Abbild. Holz.* 67, t. 54. — Sprengel, *Syst.* iii. 863. — Torrey, *Fl. N. Y.* ii. 190. — Emerson, *Trees Mass.* 150, t. 11; ed. 2, 170, t. — Dietrich, *Syn.* v. 311. — Darlington, *Fl. Cestr.* ed. 3, 268. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 41. — Chapman, *Fl.* 423. — A. de Candolle, *Prodr.* xvi. pt. ii. 59. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 72; *Liebmann Chênes Am. Trop.* t. D. — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 343. — Koch, *Dendr.* ii. pt. ii. 66. — Lauche, *Deutsche Dendr.* 297, f. 121. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 184. — Houba, *Chênes Am. en Belgique*, 262, t. — Watson & Coulter, *Gray's Man.* ed. 6, 478. — Dippel, *Handb. Laubholzk.* ii. 113. — Koehne, *Deutsche Dendr.* 132.

Quercus Banisteri, Michaux, *Hist. Chênes Am.* No. 15, t. 27 (1801); *Fl. Bor.-Am.* ii. 199. — Desfontaines, *Hist. Arb.* ii. 510. — Poiret, *Lam. Dict.* Suppl. ii. 222. — Michaux f. *Hist. Arb. Am.* ii. 96, t. 19. — Pursh, *Fl. Am. Sept.* ii. 631. — *Nouveau Duhamel*, vii. 173, t. 50. — Hooker, *Fl. Bor.-Am.* ii. 158.

Quercus discolor, γ **Banisteri**, Spach, *Hist. Vég.* xi. 164 (1842).

An intricately branched shrub, with numerous contorted stems from three to ten feet tall; or occasionally rising with a single trunk five or six inches in diameter to the height of eighteen or twenty feet and forming a small tree with a round-topped spreading head.[1] The bark of the trunk is thin, smooth, dark brown, and covered with small closely appressed scales. The branchlets are slender and marked with small pale or dark raised lenticels; when they first appear they are dark green, more or less tinged with red, and coated with hoary pubescence, and during their first winter are red-brown or ashy gray and pubescent or puberulous, growing glabrous and darker in their second year and ultimately dark brown or nearly black. The winter-buds are ovate, obtuse, about an eighth of an inch long, and covered by dark chestnut-brown rather loosely imbricated glabrous or pilose scales. The leaves are convolute in the bud, obovate or rarely oblong in outline, gradually or abruptly wedge-shaped at the base, and from three to seven but mostly five-lobed, with acute bristle-tipped lobes and wide shallow sinuses; the terminal lobe is ovate, elongated, and rounded and three-toothed or acute and dentate or entire at the apex; the lateral lobes are spreading, mostly triangular and acute, or the upper pair, which are generally much larger than the others, are broad, oblique, and repand-lobulate at the apex; or the leaves are broad at the apex and slightly three-lobed and entire below, or deeply three-lobed above and sinuate below, or occasional leaves are oblong or oblong-obovate and entire with undulate margins; when they unfold they are dull red and puberulous or pubescent on the upper surface and coated on the lower and on the petioles with thick pale tomentum; when half grown they are light yellow-green, lustrous, slightly pubescent above and tomentose below, with conspicuous tufts of silvery white hairs in the axils of the veins; and at maturity they are thick and firm, dark green and lustrous above, and covered below with pale or silvery white pubescence, from two to five inches long and from

[1] Davis, *Torrey Bot. Club*, xix. 303.

The largest specimens of *Quercus nana* that I have seen are on the dry ridges of the so-called "barrens" in Huntingdon County in central Pennsylvania, at the eastern base of the Alleghany Mountains. (See iv. 28.)

an inch and a half to three inches and a half wide, with stout yellow midribs, slender primary veins running obliquely to the points of the lobes, and obscure secondary veins arcuate and united near the margins and connected by conspicuous primary reticulate veinlets; they are borne on slender nearly terete glabrous or pubescent petioles from an inch to an inch and a half in length, and in the autumn turn dull scarlet or yellow before falling. The stipules are linear-obovate to linear-lanceolate, brown and scarious, pubescent on the outer surface, ciliate on the margins, and caducous. The flowers appear in April and May when the leaves are about half grown; the staminate in the axils of linear-lanceolate bright red caducous bracts furnished at the ends with tufts of long pale hairs are borne on hairy-stemmed aments four or five inches in length and often persistent until midsummer; the pistillate are raised on stout tomentose peduncles. The bud of the staminate flower is bright red and coated with matted soft white hairs; the calyx after opening is red or green tinged with red, and irregularly divided into from three to five ovate rounded lobes shorter than the stamens; these are from three to five in number, with oblong sometimes apiculate anthers at first bright red but gradually becoming yellow. The involucral scales of the pistillate flower are ovate, about as long as the acute calyx-lobes, red and covered with tomentum, and the stigmas are darker red. The acorns, which are produced in great profusion and ripen during the autumn of the second season, are sessile or borne on stout peduncles sometimes half an inch long, and are in pairs or rarely solitary; the nut is ovoid, broad, flat or rounded at the base, gradually narrowed and acute or rounded at the apex, about half an inch in length, and somewhat less in breadth, light brown, lustrous and usually faintly striate, with a thin shell lined with a thick coat of pale tomentum and light yellow astringent cotyledons; the cup, which embraces about half the nut, is cup-shaped or saucer-shaped and often abruptly enlarged above the stalk-like base; it is thick, light reddish brown and puberulous within, and covered by thin ovate closely imbricated reddish brown puberulous scales darker on the margins and acute or truncate at the apex, the minute free tips of the upper scales forming a fringe-like border to the cup.[1]

Quercus nana inhabits dry sandy barrens and rocky hillsides, and is distributed from the island of Mt. Desert, off the coast of Maine,[2] southward through eastern and southern New England, where it is common; it occurs on the shores of Lake George[3] and in the valley of the Hudson River in New York, and is abundant in the Pine barrens of New Jersey and in eastern Pennsylvania, and ranges along the Alleghany Mountains to southwestern Virginia.[4]

Discovered in Virginia by the English missionary John Banister,[5] *Quercus nana* was included in his catalogue of American plants published by Ray in 1688,[6] and was first described by Clayton in the *Flora Virginica*.[7]

[1] A tree, forty feet high, found by Dr. J. W. Robbins in 1855 in a wood half a mile southwest of Whitinsville in Northbridge, Worcester County, Massachusetts, is believed to have been a hybrid between *Quercus nana* and *Quercus coccinea* (*Quercus coccinea* × *ilicifolia*, Gray, *Man.* ed. 5, 454. — *Quercus ilicifolia* × *coccinea*, Engelmann, *Trans. St. Louis Acad.* iii. 542). The leaves are oblong or oblong-obovate, sinuate-lobed with five acute bristle-pointed lobes, conspicuously reticulate-venulose, coated below with rusty pubescence, four or five inches in length and about three and a half inches in breadth. The nut is oval, narrowed and rounded at the apex, from one half to three quarters of an inch long, and inclosed to the middle in the turbinate cup, which is covered by thin closely imbricated light chestnut-brown scales. The pubescence which clothes the branchlets during the first season and the lower surface of the leaves resembles that of *Quercus nana*. The leaves, as Dr. Engelmann pointed out, are more like those of *Quercus rubra* than of *Quercus coccinea* in shape. The fruit, although the cups are a little deeper, is otherwise hardly distinguishable from that of some forms of *Quercus nana*.

At Ocean Grove, New Jersey, in 1892, Mr. J. K. Hayward found in a small wood a plant without fruit which has the appearance of being a hybrid between *Quercus nana* and *Quercus velutina*. The leaves are oblong, sinuate-lobed with five acute nearly triangular bristle-pointed lobes which are entire or furnished with occasional small teeth, from five to seven inches long and from three to four inches wide, dark green and lustrous on the upper surface and brown and pubescent on the lower. The winter-buds are ovate, pilose with pale hairs, and intermediate in size between those of the supposed parents. This plant is a shrub, with three or four stems rising to a height of twelve feet.

[2] Rand & Redfield, *Fl. Mt. Desert Island*, 145.

[3] *Teste* Herb. Engelmann.

[4] In 1894 *Quercus nana* was found by Mr. J. K. Small on King and Crowder's Mountains on the northern boundary of North Carolina, the most southern recorded stations for this species, which apparently does not reach central New York, nor cross the Alleghany Mountains into the Mississippi Basin.

[5] See i. 6.

[6] *Quercus pumila*, *Hist. Pl.* ii. 1927.

[7] *Quercus pumila bipedalis, foliis oblongis sinuatis subtus tomentosis*, 189.

EXPLANATION OF THE PLATE.

PLATE CCCCXXIV. QUERCUS NANA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate inflorescence, enlarged.
4. A fruiting branch, natural size.
5. A fruit, natural size.
6. A fruit, natural size.
7. A fruit, natural size.
8. A leaf, natural size.
9. A leaf, natural size.
10. A leaf, natural size.
11. A winter branchlet, natural size.
12. An axillary winter-bud, enlarged.

C.E.Faxon del. *Lövendal sc.*

QUERCUS NANA, Sarg.

A.Riocreux direx.t *Imp. J. Taneur, Paris.*

QUERCUS GEORGIANA.

LEAVES glabrous, oval or obovate, variously sinuately lobed with usually acute entire lobes.

Quercus Georgiana, M. A. Curtis, *Am. Jour. Sci.* ser. 2, vii. 406 (1849). — Chapman, *Fl.* 422. — A. de Candolle, *Prodr.* xvi. pt. ii. 60. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 72. — Engelmann, *Trans. St. Louis Acad.* iii. 395. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 186. — Dippel, *Handb. Laubholzk.* ii. 116, f. 55. — Koehne, *Deutsche Dendr.* 132.

A bush, with stems usually six or eight feet tall spreading into broad thickets; or rarely of arborescent habit and thirty feet in height, with a trunk twelve or fourteen inches in diameter. The bark of the trunk is thin, light brown, and covered with small appressed scales. The branchlets are slender and marked with minute pale lenticels; glabrous and dark green more or less deeply tinged with red when they appear, in their first winter they are red and lustrous, and grow darker in their second season, and ultimately dark brown or gray. The winter-buds are ovate, acute or obtuse, about an eighth of an inch long, and covered by light chestnut-brown scales thin and scarious on the margins. The leaves are convolute in the bud, oval or obovate in outline, gradually narrowed and wedge-shaped at the base, and divided, generally about half way to the midribs, by wide or narrow oblique sinuses, which are rounded at the bottom, into from three to seven bristle-tipped lobes; the terminal lobe is ovate, acute or rounded, and entire or frequently furnished with one or two small lateral teeth; the lateral lobes are oblique or spreading, mostly triangular, acute and entire, or those of the upper or of the middle pair which are usually much larger than the others are often broad and repand-lobulate at the oblique ends; sometimes the leaves are slightly three-lobed at the broad apex and gradually narrowed and entire below, or are equally three-lobed with broad or narrow spreading lateral lobes, or occasionally they are pinnatifid, and entire and often undulate; when they unfold they are bright green tinged with red, ciliate on the margins and coated on the midribs, veins, and petioles with loose pale stellate pubescence; and at maturity they are thin, bright green and lustrous above, and paler below and glabrous or furnished with tufts of villous hairs in the axils of the primary veins; usually about two and a half inches long and an inch and a half wide, they vary from one to four inches in length and from half an inch to three and a half inches in width, with slender yellow midribs and primary veins rounded on the upper side, obscure secondary veins arcuate and united near the thin firm margins, and conspicuous reticulate veinlets; they are borne on slender slightly grooved petioles from one half to three quarters of an inch in length, and turn dull orange and scarlet in the autumn before falling. The stipules are linear-lanceolate, about half an inch long, brown and scarious, and caducous. The flowers appear in April when the leaves are about half grown, the staminate borne in slender glabrous or pubescent aments two or three inches in length, and the pistillate on short glabrous slender peduncles. The calyx of the staminate flower is divided into four or five broadly ovate rounded segments rather shorter than the stamens, which are four or five in number with oblong slightly emarginate glabrous yellow anthers. The involucral scales of the pistillate flower are rather shorter than the acute calyx-lobes and are pubescent or puberulous; the elongated stigmas are bright red. The fruit ripens in the autumn of the second season and is borne on a stout peduncle rarely more than a quarter of an inch in length; the nut is ellipsoidal or subglobose, from one third to one half of an inch long, and light reddish brown and lustrous; the cup, which incloses from one third to nearly one half of the nut, is cup-shaped, thick, light red-brown and lustrous on the inner surface, and covered by thin ovate bright light red-brown truncate scales erose on the margins.[1]

[1] A supposed hybrid between *Quercus Georgiana* and *Quercus Marilandica* is described by Mr. J. K. Small (*Quercus Georgiana* × *nigra*, *Bull. Torrey Bot. Club*, xxii. 75, t. 233), who found it on the northern slope of Stone Mountain in January, 1894.

Quercus Georgiana inhabits the slopes of Stone Mountain, an isolated granite rock with an altitude of nearly seventeen hundred feet above the level of the sea, in De Kalb County in central Georgia, where it was discovered by Mr. H. W. Ravenel,[1] and on a few other granite hills between the Yellow and Oconee Rivers in the region immediately south and east of Stone Mountain.[2]

Introduced into the Arnold Arboretum in 1876, *Quercus Georgiana* has proved perfectly hardy in eastern Massachusetts, growing as a tall shrub, and flowering and ripening its fruit.

[1] Henry William Ravenel (1814–1887) was born in the Parish of St. John's, Berkeley, South Carolina, and was graduated from the South Carolina College in 1832. After twenty years devoted to planting in his native parish, Mr. Ravenel moved to Aiken, South Carolina, where the remainder of his life was passed. Born with a fondness for natural history, he devoted himself to botany with enthusiasm and success, exploring minutely in his youth the region about St. John's, and later with equal care the vicinity of Aiken. He critically studied flowering plants and Mosses, Lichens, Fungi, and Algæ; a large number of cryptogamous and a few flowering plants were discovered by him, and his knowledge of the cryptogamic flora of the southern states was unsurpassed. Mr. Ravenel was at one time the agricultural editor of the *Weekly News and Courier* of Charleston, and at the time of his death was botanist to the Department of Agriculture of his native state. Although not a voluminous writer, Mr. Ravenel was the author of a number of critical botanical papers, but he is best known by his *Fungi Caroliniani Exsiccati* in five volumes, the first published series of named species of American Fungi. This was followed by a second series in which he was associated with Mr. M. C. Cooke, an English mycologist, of which eight volumes devoted to the species of South Carolina, Georgia, and Texas were issued. His name is also preserved by *Ravenelia*, a genus of the Uredineæ, and by many species of Cryptogams.

No other American botanist, perhaps, has minutely studied so many forms of the vegetable kingdom as Ravenel, and none has been more respected or beloved. Ruined financially by the War of Secession and afflicted for many years by deafness, which almost deprived him of the sound of the human voice, he bore his misfortunes with cheerfulness and equanimity, and labored industriously until the end of his life to increase knowledge and benefit his race. (See Farlow, *Bot. Gazette*, xii. 194.)

[2] For many years known only on Stone Mountain, in July, 1893, *Quercus Georgiana* was found by Mr. John K. Small on Little Stone Mountain, nine miles south of Stone Mountain, on an isolated granite hill eighteen miles east of Stone Mountain, and on a second granite hill twelve miles east of the first.

EXPLANATION OF THE PLATE.

PLATE CCCCXXV. QUERCUS GEORGIANA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A fruit, natural size.
6. A leaf, natural size.
7. A leaf, natural size.
8. A winter branchlet, natural size.

C.E.Faxon del. *Rapine sc.*

QUERCUS GEORGIANA, M.A. Curtis.

A.Riocreux direx.t *Imp. J. Taneur, Paris.*

QUERCUS MARILANDICA.

Black Jack. Jack Oak.

LEAVES broadly obovate, dilated and often 3 or rarely 5-lobed at the apex, rusty pubescent on the lower surface.

Quercus Marilandica, Muenchhausen, *Hausv.* v. 253 (1770). — Du Roi, *Obs.* 36; *Harbk. Baumz.* ii. 274, t. 6, f. 2. — Moench, *Bäume Weiss.* 94. — Muehlenberg & Willdenow, *Neue Schrift. Gesell. Nat. Fr. Berlin*, iii. 399.

Quercus nigra, *β*, Linnæus, *Spec.* 996 (1753). — Wangenheim, *Nordam. Holz.* 77, t. 5, f. 13.

Quercus nigra, Wangenheim, *Beschreib. Nordam. Holz.* 133 (1781). — Evelyn, *Silva*, ed. Hunter, i. 70. — Schoepf, *Mat. Med. Amer.* 137. — Walter, *Fl. Car.* 234. — Castiglioni, *Viag. negli Stati Uniti*, ii. 346. — Abbot & Smith, *Insects of Georgia*, ii. 115, t. 58. — Michaux, *Hist. Chênes Am.* No. 12, t. 22, 23; *Fl. Bor.-Am.* ii. 198. — Borkhausen, *Handb. Forstbot.* i. 712. — Willdenow, *Spec.* iv. pt. i. 442. — Stokes, *Bot. Mat. Med.* iv. 408. — Persoon, *Syn.* ii. 569. — Desfontaines, *Hist. Arb.* ii. 509. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 424. — Pursh, *Fl. Am. Sept.* ii. 629. — *Nouveau Duhamel*, vii. 168. — Elliott, *Sk.* ii. 600. — Sprengel, *Syst.* iii. 862. — Spach, *Hist. Vég.* xi. 162. — Torrey, *Fl. N. Y.* ii. 188; *Bot. Mex. Bound. Surv.* 206. — Audubon, *Birds*, t. 116. — Dietrich, *Syn.* v. 310. — Darlington, *Fl. Cestr.* ed. 3, 267. — Brendel, *Trans. Ill. Agric. Soc.* iii. 625, t. 7. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 38. — Chapman, *Fl.* 421. — A. de Candolle, *Prodr.* xvi. pt. ii. 63. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 72; *Liebmann Chênes Am. Trop.* t. A. — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 350. — Vasey, *Am. Ent. and Bot.* ii. 313, f. 198. — Koch, *Dendr.* ii. pt. ii. 61. — Ridgway, *Proc. U. S. Nat. Mus.* v. 82. — Lauche, *Deutsche Dendr.* 296. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 150. — Houba, *Chênes Am. en Belgique*, 251, t. — Watson & Coulter, *Gray's Man.* ed. 6, 478.

Quercus nigra, *β* **latifolia**, Lamarck, *Dict.* i. 721 (1783).

Quercus nigra integrifolia, Marshall, *Arbust. Am.* 121 (1785).

Quercus ferruginea, Michaux f. *Hist. Arb. Am.* ii. 92, t. 18 (1812). — Lauche, *Deutsche Dendr.* 296. — Dippel, *Handb. Laubholzk.* ii. 110, f. 51.

Quercus nigra, *β* **quinqueloba**, A. de Candolle, *Prodr.* xvi. pt. ii. 64 (1864).

A tree, twenty or thirty, or occasionally forty or fifty feet in height, with a trunk rarely more than eighteen inches in diameter, and short stout spreading often contorted branches which form a narrow compact round-topped or sometimes open irregular head. The bark of the trunk is from an inch to an inch and a half in thickness, and is deeply divided into nearly square plates from one to three inches in length and covered with small closely appressed dark brown or almost black scales. The branchlets are stout and marked with minute pale lenticels, and are coated at first with a thick pale tomentum of articulate and stellate hairs; during the summer they are light red and scurfy pubescent, and during their first winter light or dark reddish brown, and glabrous or puberulous, gradually growing dark brown or ashy gray. The winter-buds are ovate or oval, prominently angled, acute, light reddish brown, covered with rusty brown hairs, and about a quarter of an inch long. The leaves are convolute in the bud, broadly obovate, and rounded or cordate at the narrowed base, and are usually three or rarely five-lobed at the broad and often abruptly dilated apex, with short or elongated, broad or narrow, rounded or acute, entire or dentate, bristle-tipped lobes; or they are entire or dentate at the apex; some individual leaves are oblong-obovate, undulate-lobed at the broad apex and entire below; others are almost equally three-lobed with elongated spreading lateral lobes broad and lobulate at the apex, and others are sinuate-lobed or deeply divided by shallow sinuses into broad oblique rounded lobes; when they unfold they are coated with a pale clammy tomentum of articulate hairs and are bright pink on the upper surface; when half grown they are thin, covered with pale pubescence, dark green above and rusty brown on the lower surface, which is furnished in the axils of the veins with large tufts of whitish hairs; and at maturity they are thick and firm or subcoriaceous, dark yellow-green and very lustrous above, and yellow,

orange-color, or brown and scurfy-pubescent below; usually six or seven inches long and broad, they vary from three to eight inches in length and from two to eight inches in width, with thick broad orange-colored midribs much raised and rounded on the upper side, primary veins that are stout when they run to the points of the lobes and slender and arcuate on the lower part of the leaf, thin secondary veins, and coarsely reticulate veinlets; they are borne on stout yellow glabrous or pubescent petioles grooved on the upper side and from one half to three quarters of an inch in length, and turn brown or yellow in the autumn before falling. The stipules are oblong-obovate or linear-lanceolate, coated, especially above the middle, with long hairs, about three quarters of an inch in length, brown and scarious, and caducous. The flowers appear from March in the south to May in the north, when the leaves are about half grown, the staminate borne in hairy aments from two to four inches long, the pistillate on short peduncles clothed with thick rusty tomentum. The calyx of the staminate flower is thin and scarious, tinged with red above the middle, coated on the outer surface with pale pubescence, and divided into four or five broad ovate rounded lobes; the stamens are usually four in number, with oblong apiculate dark red glabrous anthers. The involucral scales of the pistillate flower are coated with rusty tomentum and are about as long as the acute calyx-lobes; the short broad stigmas are reflexed and dark red. The acorns, which ripen in the autumn of the second year, are solitary or in pairs and are generally borne on stout peduncles rarely half an inch in length; the nut is oblong, full and rounded at both ends, rather broader below than above the middle, about three quarters of an inch long, light yellow-brown and often striate, with a thin shell lined with a coat of dense fulvous tomentum; the cup, which incloses from one third to nearly two thirds of the nut, is thick, turbinate, light brown and puberulous on the inner surface, and covered by large reddish brown loosely imbricated scales often ciliate with long hairs, and coated with loose pale or rusty tomentum; inserted on the top of the cup in several rows smaller scales stand erect and form a thick rim around the inner surface, or occasionally are reflexed and cover the upper half of the inner surface of the cup.

The Black Jack grows on dry sandy barrens or sometimes in the southwest on heavy clays, and is distributed from Forbell's Landing and Pine Island, Long Island, New York, through northern Ohio and Indiana to southeastern Nebraska,[1] central Kansas[2] and the Indian Territory, and southward to the shores of Matanzas Inlet and Tampa Bay, Florida, and to the valley of the Nueces River in Texas. Rare in the north, it is very abundant in the south, and west of the Mississippi River, forming on sterile soil in some parts of western Missouri and eastern Kansas, in the Indian Territory and central Texas, a great part of the forest-growth, and attaining its largest size in southern Arkansas and eastern Texas.[3]

The wood of *Quercus Marilandica* is heavy, hard, and strong, but checks badly in drying; it is dark rich brown, with thick lighter colored sapwood, and contains broad conspicuous medullary rays and broad bands of several rows of large open ducts marking the layers of annual growth. The specific gravity of the absolutely dry wood is 0.7324, a cubic foot weighing 45.64 pounds. It is largely used as firewood and in the manufacture of charcoal, but has little value for other purposes.

Quercus Marilandica appears to have been first described by Ray in the *Historia Plantarum*,

[1] Bessey, *Rep. Nebraska State Board Agric.* 1894, 110.

[2] Mason, *Eighth Bienn. Rep. State Board Agric. Kansas*, 272.

[3] A group of small shrubby trees discovered in September, 1892, at Watchogue, Staten Island, New York, by Mr. William T. Davis and described by him as *Quercus Brittoni* (*Bull. Torrey Bot. Club*, xix. 301) were believed by the author to be hybrids between *Quercus Marilandica* and *Quercus nana* which grow together at this place. The leaves are broadly obovate, gradually narrowed to the wedge-shaped base, sinuately lobed toward the broad apex with bristle-tipped mostly entire or remotely dentate lobes; when they unfold they are red and covered on the upper surface with pale stellate hairs, and are pale and tomentose on the lower, with large tufts of whitish hairs in the axils of the primary veins; and when fully grown they are about four inches long and from three to four inches broad, dark green and lustrous above and rusty brown and scurfy-pubescent below. The fruit I have not seen. From the pale color of their bark, these supposed hybrids are said by Mr. Davis to present a lighter appearance than *Quercus Marilandica*, which they resemble in the general aspect of their leaves.

published in 1704.[1] According to Aiton,[2] it was cultivated by Philip Miller in the Physic Garden at Chelsea, near London, in 1739.

The Black Jack is one of the most distinct Oaks of North America. Its presence indicates sterile soil, but it is often handsome in habit, and its large lustrous and peculiarly shaped leaves are always beautiful.

[1] *Quercus* (*fortè*) *Marilandica folio trifido, ad Sassafras accedente*, iii. *Dendr.* 7. — Catesby, *Nat. Hist. Car.* i. 19, t. 19. — Charlevoix, *Histoire de la Nouvelle France*, ed. 12mo, iv. 334, f. 44. — Romans, *Nat. Hist. Florida*, 18.

[2] *Hort. Kew.* iii. 357. — Loudon, *Arb. Brit.* iii. 1890, f. 1764, 1765.

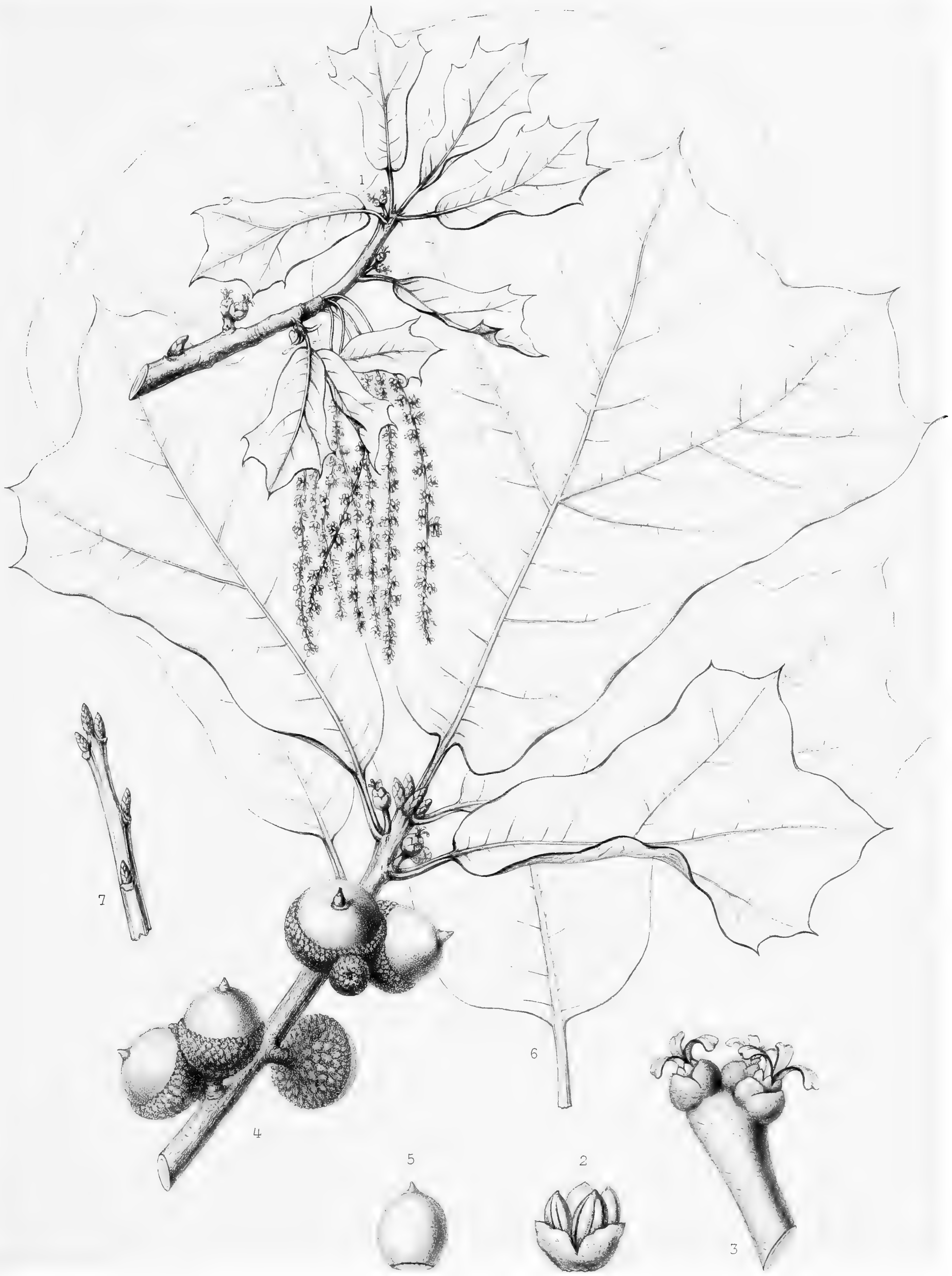
EXPLANATION OF THE PLATES.

Plate CCCCXXVI. Quercus Marilandica.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate inflorescence, enlarged.
4. A fruiting branch, natural size.
5. A nut, natural size.
6. A leaf, natural size.
7. A winter branchlet, natural size.

Plate CCCCXXVII. Quercus Marilandica.

1. A fruiting branch, natural size.
2. A cup, natural size.
3. A cup, natural size.
4. A leaf, natural size.
5. A leaf, natural size.
6. A leaf, natural size.



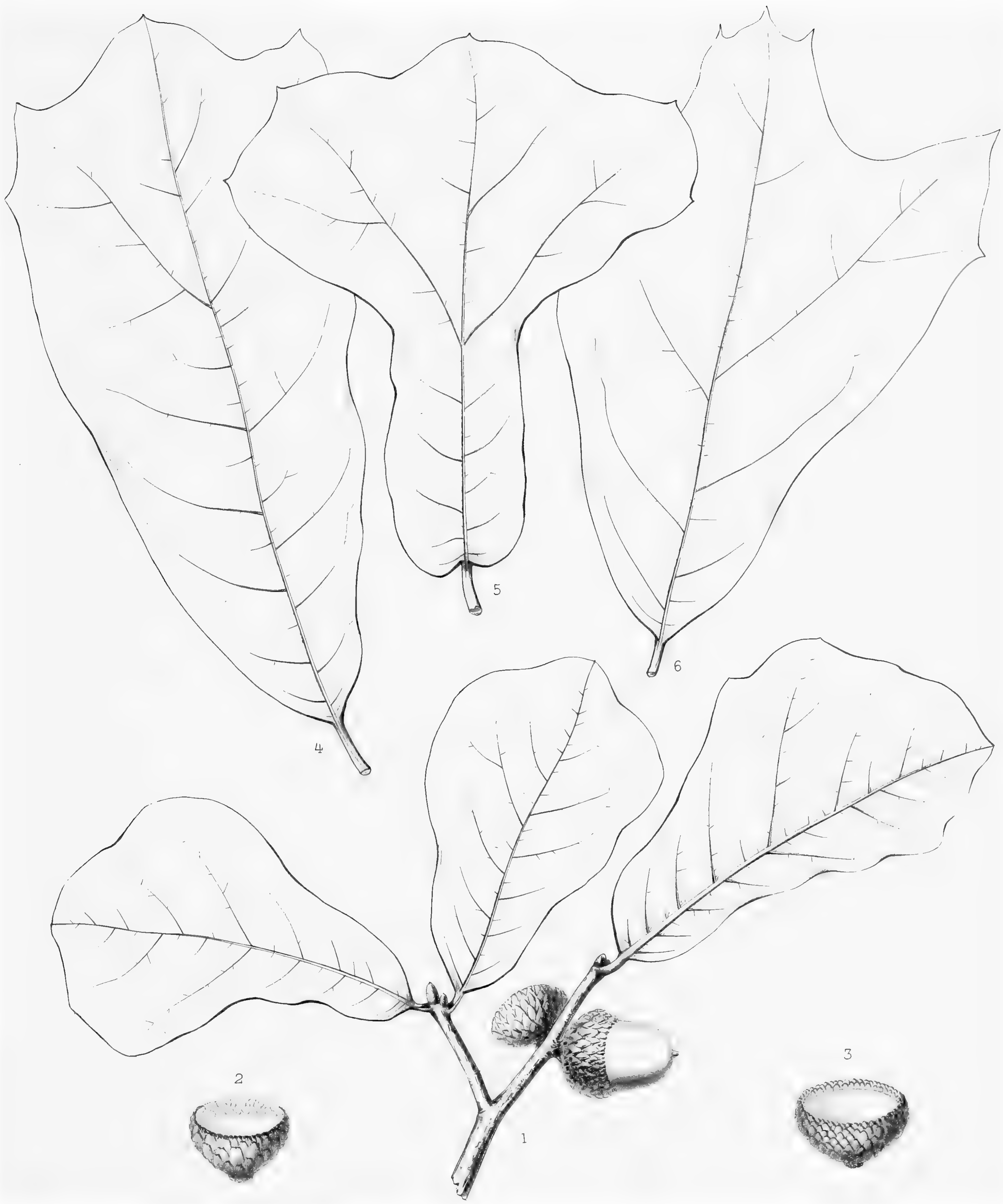
C.E.Faxon del.

Rapine sc.

QUERCUS MARILANDICA, Muench.

A.Riocreux direx.t

Imp. J. Taneur, Paris.



C.E. Faxon del. *Himely sc.*

QUERCUS MARILANDICA, Muench.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

QUERCUS NIGRA.

Water Oak.

LEAVES glabrous, usually oblong-obovate, entire or obscurely 3-lobed at the broad rounded apex.

Quercus nigra, Linnæus, *Spec.* 995 (1753). — Miller, *Dict.* ed. 8, No. 10. — Muenchhausen, *Hausv.* v. 252. — Muehlenberg & Willdenow, *Neue Schrift. Gesell. Nat. Fr. Berlin*, iii. 399. — Koch, *Dendr.* ii. pt. ii. 61 (in part).

Quercus nigra, α **aquatica**, Lamarck, *Dict.* i. 721 (1783). — Castiglioni, *Viag. negli Stati Uniti*, ii. 346.

Quercus nigra trifida, Marshall, *Arbust. Am.* 121 (1785).

Quercus uliginosa, Wangenheim, *Nordam. Holz.* 80, t. 6, f. 18 (1787). — Koehne, *Deutsche Dendr.* 131. — Dippel, *Handb. Laubholzk.* ii. 109, f. 50.

Quercus aquatica, Walter, *Fl. Car.* 234 (1788). — Abbot & Smith, *Insects of Georgia*, ii. 117, t. 59. — Michaux, *Hist. Chênes Am.* No. 11, t. 19, 20, 21; *Fl. Bor.-Am.* ii. 198. — Persoon, *Syn.* ii. 569. — Bosc, *Mém. Inst. Nat. Sci. Phys. Math.* viii. pt. i. 346. — Desfontaines, *Hist. Arb.* ii. 509. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 424. — Poiret, *Lam. Dict.* Suppl. ii. 220. — Michaux f. *Hist. Arb. Am.* ii. 89, t. 17. — Pursh, *Fl. Am. Sept.* ii. 628. — *Nouveau Duhamel*, vii. 168. — Elliott, *Sk.* ii. 599. — Sprengel, *Syst.* iii. 862. — Audubon, *Birds*, t. 24. — Spach, *Hist. Vég.* xi. 161. — Dietrich, *Syn.* v. 310. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 37. — Chapman, *Fl.* 421. — A. de Candolle, *Prodr.* xvi. pt. ii. 67. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 72; *Liebmann Chênes Am. Trop.* t. D. — Vasey, *Am. Ent. and Bot.* ii. 312, f. 197. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 152. — Watson & Coulter, *Gray's Man.* ed. 6, 478. — Mayr, *Wald. Nordam.* 150, t. 1, 2. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 417 (*Man. Pl. W. Texas*).

Quercus hemisphærica, Willdenow, *Spec.* iv. pt. i. 443 (1805). — Poiret, *Lam. Dict.* Suppl. ii. 220. — Pursh, *Fl. Am. Sept.* ii. 628. — Nuttall, *Gen.* ii. 214.

? **Quercus nana**, Willdenow, *Spec.* iv. pt. i. 443 (1805). — Poiret, *Lam. Dict.* Suppl. ii. 220.

Quercus aquatica, α **cuneata**, Aiton, *Hort. Kew.* ed. 2, v. 290 (1813).

Quercus aquatica, γ **elongata**, Aiton, *Hort. Kew.* ed. 2, v. 290 (1813).

Quercus aquatica, δ **indivisa**, Aiton, *Hort. Kew.* ed. 2, v. 290 (1813).

Quercus aquatica, ε **attenuata**, Aiton, *Hort. Kew.* ed. 2, v. 290 (1813).

? **Quercus hemisphærica**, var. **nana**, Nuttall, *Gen.* ii. 214 (1818).

Quercus aquatica, var. **hybrida**, Chapman, *Fl.* 421 (1860).

A tree, occasionally eighty feet in height, with a trunk from two to three and a half feet in diameter and numerous rather slender branches which, spreading gradually from the stem, form a symmetrical conical round-topped head, or often, on young trees, spreading nearly at right angles, form a flat and broader head. The bark of the trunk is from one half to three quarters of an inch in thickness, with a smooth light brown surface slightly tinged with red and covered with smooth closely appressed scales. The branchlets are slender, glabrous, marked with minute lenticels, light or dull red during their first winter and grayish brown in their second season. The winter-buds are ovate, acute, strongly angled, and covered by loosely imbricated dark red-brown puberulous scales slightly ciliate on the thin scarious margins. The leaves are convolute in the bud, usually oblong-obovate, gradually narrowed and wedge-shaped at the base, enlarged, sometimes abruptly, at the broad generally rounded or sometimes pointed entire or slightly or deeply three-lobed bristle-tipped apex; or they often taper from near the middle to the acute ends, or on upper branches are often linear-lanceolate or linear-obovate and acute or rounded at the apex; on the same shoot they are frequently divided above the middle by deep wide sinuses rounded at the bottom into elongated lanceolate acute entire lobes, or are pinnatifid above the middle; and on vigorous shoots they are often oblong-obovate, sinuately lobed with numerous acute dentate lobes, and four or five times as large as on fertile branches, or are linear-lanceolate, entire or furnished with a few small rounded lateral lobes; when they unfold they are thin, light green more or less tinged with red, covered with fine caducous pubescence, and furnished on the lower surface

with conspicuous tufts of pale hairs in the axils of the veins; and at maturity they are thin but firm in texture, dull bluish green, paler below than on the upper surface, and glabrous or marked with axillary tufts of rusty hairs; usually about two and a half inches long and an inch and a half wide, they vary on fertile branches from an inch and a half to six inches in length and from one to two and a half inches in width, with midribs raised and rounded on the upper side, slender primary veins generally arcuate and united within the slightly revolute margins, and conspicuous reticulate veinlets; they are borne on stout flattened grooved petioles from one eighth to nearly one half of an inch long and fall gradually during the winter. The flowers appear from February to April, the staminate borne on red hairy-stemmed aments from two to three inches in length, and the pistillate on short tomentose peduncles. The calyx of the staminate flower is thin and scarious, coated on the outer surface with short hairs, and deeply divided into four or five ovate rounded segments; the stamens are four or five in number, with oblong emarginate glabrous yellow anthers. The involucral scales of the pistillate flower are a little shorter than the acute calyx-lobes and are coated with rusty hairs; the stigmas are reflexed and deep red. The fruit ripens late in the autumn of the second season and is sessile or borne on a stout peduncle rarely more than an eighth of an inch long, and is usually solitary; the nut is ovoid, broad and flat at the base, full and rounded at the apex, which is covered with rufous pubescence, light yellow-brown and often striate, from one third to two thirds of an inch in length and a little less in breadth, with a thick shell lined with fulvous tomentum, and bright yellow cotyledons; the cup is thin and flat on the bottom and is generally saucer-shaped, embracing only the very base of the nut, but occasionally is cup-shaped and incloses fully a third of the nut; it is coated on the inner surface above the large yellow scar with pale silky tomentum, and is covered by ovate acute closely appressed light red-brown scales which are clothed with pale pubescence, except on their darker colored margins, and are sometimes slightly thickened toward the base of the cup.

Quercus nigra inhabits the high sandy borders of swamps and streams and the rich bottom-lands of rivers, and is distributed from southern Delaware southward to Cape Malabar and the shores of Tampa Bay, Florida, ranging inland through the south Atlantic states to the base of the Appalachian mountains, and westward through the Gulf states to the valley of the Colorado River in Texas, through the eastern borders of the Indian Territory and through Arkansas to the valley of the Black River in southeastern Missouri, and to central Tennessee and Kentucky.

The wood of *Quercus nigra* is heavy, hard, strong, and close-grained; it is light brown, with thick lighter colored sapwood, and contains thin conspicuous medullary rays and broad bands of open ducts marking the layers of annual growth. The specific gravity of the absolutely dry wood is 0.7244, a cubic foot weighing 45.14 pounds. Except as fuel it has little value.

Quercus nigra[1] was first described by Catesby in the *Natural History of Carolina*, published in 1731,[2] although according to Aiton[3] it was cultivated by Mr. Thomas Fairchild[4] in England before 1733. The ease with which it can be transplanted and the rapidity of its growth have made this Water Oak a favorite shade-tree in the southern states, and it is frequently planted in the streets and squares of towns and in pleasure-grounds.

[1] *Quercus nigra* is also sometimes called Duck Oak, Possum Oak, and Punk Oak.

[2] *Quercus folio non serrato, in summitate quasi triangulo*, i. 20, t. 20. — Romans, *Nat. Hist. Florida*, 18.

Quercus foliis cuneiformibus obsolete trilobis, Clayton, *Fl. Virgin.* 117.

Le Chêne d'eau, Charlevoix, *Histoire de la Nouvelle France*, ed. 12mo, iv. 335, f. 47.

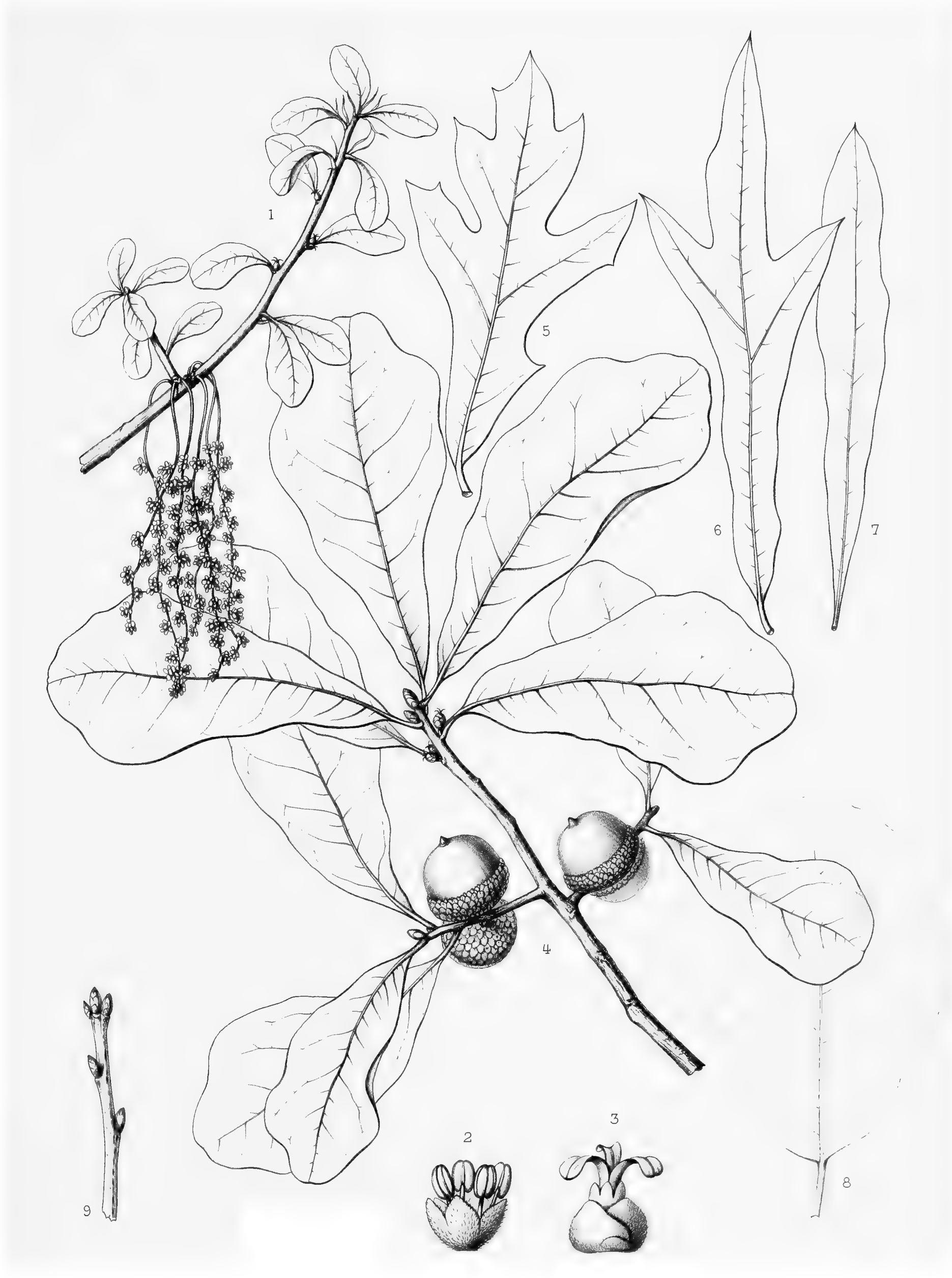
[3] *Hort. Kew.* ed. 2, v. 291. — Loudon, *Arb. Brit.* iii. 1892, f. 1767, 1768.

[4] See v. 68.

EXPLANATION OF THE PLATE.

Plate CCCCXXVIII. Quercus nigra.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A leaf, natural size.
6. A leaf, natural size.
7. A leaf, natural size.
8. A leaf, natural size.
9. A winter branchlet, natural size.



C.E.Faxon del. *Lebrun sc.*

QUERCUS NIGRA, L.

A.Riocreux direx.t *Imp. J.Taneur, Paris.*

QUERCUS LAURIFOLIA.

Water Oak.

LEAVES oblong-oval or oblong-obovate, narrowed at both ends, dark green and lustrous.

Quercus laurifolia, Michaux, *Hist. Chênes Am.* No. 10, t. 17 (1801); *Fl. Bor.-Am.* ii. 197. — Willdenow, *Spec.* iv. pt. i. 427. — Persoon, *Syn.* ii. 567. — Pursh, *Fl. Am. Sept.* ii. 627. — Nuttall, *Gen.* ii. 214. — *Nouveau Duhamel*, vii. 153. — Elliott, *Sk.* ii. 597. — Sprengel, *Syst.* iii. 857. — Dietrich, *Syn.* v. 306. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 36. — Örsted, *Liebmann Chênes Am. Trop.* t. D. — Engelmann, *Trans. St. Louis Acad.* iii. 386, 395. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 152. — Mayr, *Wald. Nordam.* 150, t. 1, 2.

Quercus laurifolia hybrida, Michaux, *Hist. Chênes Am.* No. 10, t. 18 (1801).

Quercus laurifolia, α **acuta**, Willdenow, *Spec.* iv. pt. i. 428 (1805). — Aiton, *Hort. Kew.* ed. 2, v. 288.

Quercus laurifolia, β **obtusa**, Willdenow, *Spec.* iv. pt. i. 428 (1805). — Aiton, *Hort. Kew.* ed. 2, v. 288.

Quercus obtusa, Pursh, *Fl. Am. Sept.* ii. 627 (1814).

Quercus Phellos, var. **laurifolia**, Chapman, *Fl.* 420 (1860).

Quercus aquatica, α **laurifolia**, A. de Candolle, *Prodr.* xvi. pt. ii. 68 (1864). — Houba, *Chênes Am. en Belgique*, 306, t.

A tree, occasionally one hundred feet in height, with a tall trunk three or four feet in diameter and comparatively slender branches which spread gradually into a broad dense round-topped shapely head. The bark at the base of old trees is one or two inches in thickness, nearly black, and divided by deep fissures into broad flat ridges; higher up on the trunk and on the main stems of young trees it is from half an inch to an inch in thickness, dark brown more or less tinged with red and roughened with small closely appressed scales. The branchlets are slender, covered with pale lenticels, glabrous, dark red when they first appear and dark red-brown during their first winter, becoming reddish brown or dark gray in their second year. The winter-buds are broadly ovate or oval, abruptly narrowed and acute at the apex, from one sixteenth to one eighth of an inch long, and covered by numerous thin closely imbricated bright red-brown scales ciliate on the margins. The leaves are involute in the bud, oblong-oval or oblong-obovate, sometimes falcate, gradually narrowed and acute or rarely rounded at the base, acute or occasionally rounded at the bristle-pointed apex, and entire with slightly thickened cartilaginous often undulate margins, or near the extremities of the vigorous branches of young trees they are frequently unequally lobed, generally below the middle or near the base, with small almost triangular acute bristle-pointed lobes; when they unfold they are thin, green tinged with dark red, and slightly puberulous, especially on the lower surface, and at maturity are thin but firm in texture, green and very lustrous above and light green and less lustrous below; usually three or four inches long and three quarters of an inch wide, they vary from an inch and a half to six inches in length and from half an inch to two inches in width, with conspicuous yellow midribs much raised and rounded on the upper side, and obscure primary veins arcuate and united near the margins and connected by many closely reticulated veinlets which are more conspicuous on the upper than on the lower surface; they are borne on stout grooved yellow petioles rarely more than a quarter of an inch long, and fall irregularly during the winter. The flowers appear in March and April when the leaves are about one third grown, the staminate borne in red-stemmed hairy aments from two to three inches in length, and the pistillate on stout glabrous peduncles. The calyx of the staminate flower is thin and scarious, pubescent on the outer surface, and deeply divided into four ovate rounded lobes; the stamens are four or five in number, with oblong slightly emarginate yellow glabrous anthers. The involucral scales of the pistillate flower are brown and hairy and about as long as the acute calyx-lobes; the stigmas are

short, recurved, and dark red. The acorns ripen early in the autumn of the second year and are sessile or subsessile, and generally solitary; the nut is nearly ovoid or hemispherical, broad and slightly rounded at the base, full, rounded and puberulous at the apex, dark brown when first ripe, but as it dries sometimes becoming striate with brown and dark olive-green stripes, and about half an inch in length and in breadth, with a thin shell lined with a slight coat of pale tomentum and bright orange-colored bitter cotyledons; the cup, which embraces nearly a quarter of the nut, is thin, saucer-shaped, and reddish brown and silky-pubescent on the inner surface, with a large bright orange-colored scar, and is covered by thin ovate light red-brown scales rounded at the ends and coated with pale pubescence except on their darker colored margins.

Quercus laurifolia inhabits the sandy banks of streams and swamps and rich hummocks in the neighborhood of the coast, and is distributed from the Dismal Swamp in Virginia[1] southward to the shores of Mosquito Inlet and Cape Romano in Florida, and along the Gulf coast to Louisiana. Nowhere very abundant, it is most common and attains its largest size in eastern Florida.

The wood of *Quercus laurifolia* is heavy, and very strong and hard, but coarse-grained and liable to check badly in drying; it is dark brown tinged with red, with thick lighter colored sapwood, and contains broad conspicuous medullary rays and bands of small open ducts marking the layers of annual growth. The specific gravity of the absolutely dry wood is 0.7673, a cubic foot weighing 47.82 pounds. It is probably used only as fuel.

Quercus laurifolia appears to have escaped the notice of early botanists, although among American species it is surpassed in beauty only by the Live Oak, with which it frequently grows on sandy coast hummocks. It is the common Water Oak in the streets and squares of the cities of the south Atlantic and Gulf coasts from Wilmington, North Carolina, to New Orleans, often adorning them with its tall column-like shafts and noble heads of lustrous dark green foliage.

[1] *Quercus laurifolia* was collected in the Dismal Swamp in 1877 by Mr. L. F. Ward.

EXPLANATION OF THE PLATES.

PLATE CCCCXXIX. QUERCUS LAURIFOLIA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A leaf of a sterile branch of a young tree, natural size.
6. A winter branchlet, natural size.

PLATE CCCCXXX. QUERCUS LAURIFOLIA.

1. A fruiting branch, natural size.
2. A fruiting branch, natural size.

C.E. Faxon del. Himely sc.

QUERCUS LAURIFOLIA, Michx.

A. Riocreux direx.t Imp. J. Taneur, Paris.

C.E.Faxon del.

Himely sc.

QUERCUS LAURIFOLIA, Michx.

A.Riocreux direx.t

Imp. J. Taneur, Paris.

QUERCUS BREVIFOLIA.

Blue Jack.

LEAVES oblong-lanceolate or oblong-obovate, pale and tomentose on the lower surface.

Quercus brevifolia.

Quercus Phellos, β brevifolia, Lamarck, *Dict.* i. 722 (1783).

Quercus humilis, Walter, *Fl. Car.* 234 (not Lamarck) (1788). — Koch, *Dendr.* ii. pt. ii. 58.

Quercus Phellos, β sericea, Aiton, *Hort. Kew.* iii. 354 (1789). — Loudon, *Arb. Brit.* iii. 1895, f. 1773. — Spach, *Hist. Vég.* xi. 161.

Quercus Phellos, β latifolia, Castiglioni, *Viag. negli Stati Uniti,* ii. 345 (excl. syn. Marshall) (1790).

Quercus Phellos, β, Smith, *Abbot & Smith Insects of Georgia,* ii. 103, t. 52 (1797).

Quercus cinerea, Michaux, *Hist. Chênes Am.* No. 8, t. 14 (1801); *Fl. Bor.-Am.* ii. 197. — Willdenow, *Spec.* iv. pt. i. 425. — Persoon, *Syn.* ii. 567. — Poiret, *Lam. Dict.* Suppl. ii. 212. — Michaux f. *Hist. Arb. Am.* ii. 82, t. 14. — Aiton, *Hort. Kew.* ed. 2, v. 288. — Pursh, *Fl. Am. Sept.* ii. 626. — Nuttall, *Gen.* ii. 214. — *Nouveau Duhamel,* vii. 151. — Elliott, *Sk.* ii. 594. — Sprengel, *Syst.* iii. 857. — Scheele, *Roemer Texas,* 447. — Dietrich, *Syn.* v. 306. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 37. — Chapman, *Fl.* 421. — A. de Candolle, *Prodr.* xvi. pt. ii. 73. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 73. — Gray, *Man.* ed. 5, 452. — Engelmann, *Trans. St. Louis Acad.* iii. 386, 395. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 153. — Dippel, *Handb. Laubholzk.* ii. 105, f. 47. — Koehne, *Deutsche Dendr.* 131. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 417 (*Man. Pl. W. Texas*).

Quercus Phellos, β humilis, Pursh, *Fl. Am. Sept.* ii. 625 (1814). — A. de Candolle, *Prodr.* xvi. pt. ii. 74.

Quercus cinerea, β dentato-lobata, A. de Candolle, *Prodr.* xvi. pt. ii. 73 (1864).

Quercus cinerea, γ humilis, A. de Candolle, *Prodr.* xvi pt. ii. 74 (1864).

A tree, usually fifteen or twenty feet tall, with a trunk five or six inches in diameter and stout rigid branches which form a narrow irregular head, but occasionally rising to the height of fifty feet and forming a trunk eighteen or twenty inches in diameter and a broad round-topped shapely head. The bark of the trunk is from three quarters of an inch to an inch and a half in thickness, and is divided into thick nearly square plates from one to two inches long and covered with small dark brown nearly black scales slightly tinged with red. The branchlets are stout, rigid, and roughened by numerous elevated lenticels, and are coated at first with dense fulvous hoary tomentum of articulate and stellate hairs; their covering gradually disappears, and during their first winter they are dark brown sometimes tinged with red, and glabrous or puberulous, becoming darker in their second season. The winter-buds are ovate, acute, covered by numerous rather loosely imbricated bright chestnut-brown scales ciliate on the margins, and often a quarter of an inch long on vigorous branches, or frequently obtuse and much smaller. The leaves are involute in the bud, oblong-lanceolate or oblong-obovate, gradually narrowed and wedge-shaped or sometimes rounded at the base, acute or rounded and apiculate at the apex, and entire, with slightly thickened undulate margins, or on the extremities of vigorous sterile branches occasionally three-lobed at the apex and variously lobed on the margins; when they unfold they are bright pink and pubescent on the upper surface, and coated on the lower with thick silvery white tomentum, and when fully grown are firm in texture, blue-green, lustrous, and conspicuously reticulate-venulose above and coated below with pale tomentum, from two to five inches long and from half an inch to an inch and a half wide, with stout yellow midribs raised and rounded on the upper side and remote obscure primary veins forked and united within the margins; they are borne on stout grooved and flattened petioles from one quarter to one half of an inch in length and fall irregularly late in the autumn or early in winter. The stipules are oblong-obovate or linear-lanceolate, from one

half to three quarters of an inch long, brown and scarious, and caducous. The flowers appear with the unfolding of the leaves, the staminate produced in the axils of linear acute hairy caducous bracts in hoary tomentose aments two or three inches in length, and the pistillate borne on short stout tomentose peduncles. The calyx of the staminate flower before expansion is bright red, coated with pubescence, and furnished at the apex with a thick tuft of silvery white hairs; it is divided into four or five ovate acute segments and becomes yellow as it unfolds and turns brown before falling; the stamens are four or five in number, with ovate acute apiculate glabrous anthers which are dark red in the bud and yellow at maturity. The involucral scales of the pistillate flower are about as long as the acute calyx-lobes, and are coated with pale tomentum; the stigmas are dark red. The fruit, which ripens late in the autumn of the second year and is occasionally found on branches three or four years old, is usually produced in great profusion and is generally sessile or is sometimes raised on a short stem rarely a quarter of an inch long; the nut is ovate, full and rounded at both ends, or subglobose, about half an inch in length, light brown, often striate, and coated at the apex with hoary pubescence; the cup is thin and saucer-shaped, embracing only the bottom of the nut, or it is cup-shaped and incloses its lower half; it is bright red-brown and coated with lustrous pale pubescence on the inner surface, and is covered by thin closely imbricated ovate oblong scales coated, except on the dark red-brown margins, with hoary tomentum.[1]

Quercus brevifolia inhabits sandy barrens and upland ridges, and is distributed from North Carolina southward to Cape Malabar and the shores of Pease Creek in Florida, and westward along the Gulf coast to the valley of the Brazos River in Texas. In the Atlantic and eastern Gulf states it is usually confined to a maritime belt from forty to fifty miles in width,[2] although it extends across the Florida peninsula, and in Texas ranges as far inland as the neighborhood of Dallas in about thirty-three degrees north latitude.

The wood of *Quercus brevifolia* is hard, strong, and close-grained, and is light brown tinged with red, with thick darker colored sapwood; it contains thin conspicuous medullary rays and bands of small open ducts marking the layers of annual growth. The specific gravity of the absolutely dry wood is 0.6420, a cubic foot weighing 40.00 pounds. It is probably only used as fuel.

The Blue Jack[3] was first figured and described by Mark Catesby in his *Natural History of Carolina*, published in 1731.[4]

[1] Specimens of two plants found by Mr. George V. Nash in August, 1894, on the road between Umatilla and Lake Ella in Lake County, Florida, are considered hybrids of *Quercus brevifolia* and *Quercus Catesbœi* by Mr. J. K. Small. The first (*Bull. Torrey Bot. Club*, xxii. 76, t. 234) has pubescent branchlets, and ovate acute and entire or undulate-lobed leaves sometimes three-lobed at the apex, glabrous on the upper and pale and stellate-pubescent on the lower surface, and, except in the character of the covering of the lower surface, not unlike those of some forms of *Quercus brevifolia*. The scales of the half-grown fruit, however, are large and nearly glabrous, and in shape and size resemble those of *Quercus Catesbœi* rather than those of *Quercus brevifolia*.

The second of these supposed hybrids (*Bull. Torrey Bot. Club*, *l. c.* t. 235) has oblong-ovate or oblong-obovate leaves three or four inches in length, variously sinuately lobed or dentate with acute apiculate lobes or teeth, or at the base of the shoot three-lobed at the broad apex, and entire and gradually narrowed toward the rounded base; they are bright green and rather lustrous above and paler and glabrous below with the exception of occasional tufts of hairs in the axils of the veins, and are not distinguishable from the leaves sometimes produced on vigorous stump-shoots of *Quercus nigra*.

[2] A specimen without flowers or fruit gathered by Mr. John K. Small in July, 1893, on the Yellow River in Guinett County in northern Georgia, is probably of this species, although far outside its range as otherwise known.

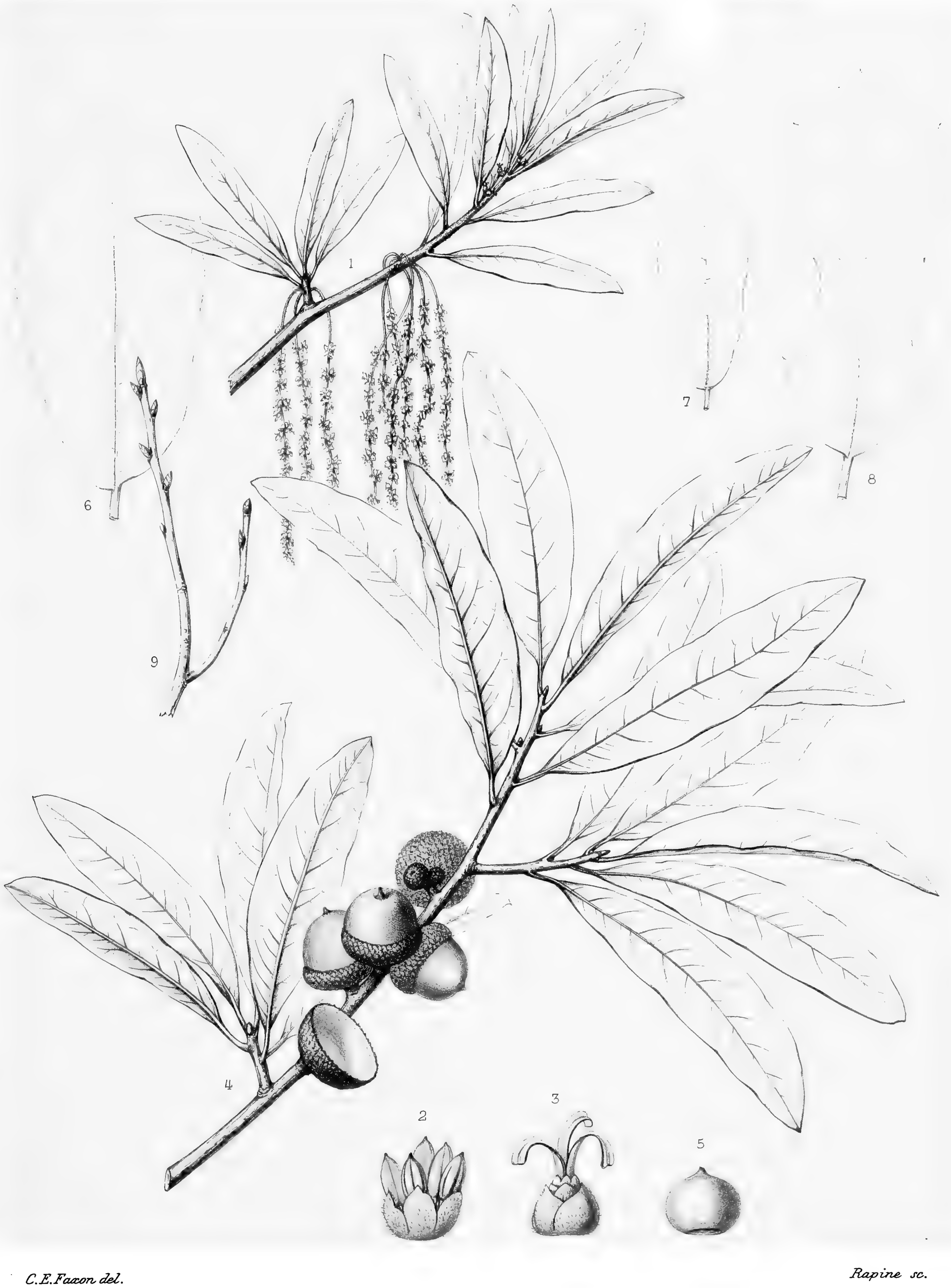
[3] *Quercus brevifolia* is also sometimes called Upland Willow Oak and Sand Jack.

[4] *Quercus humilior salicis folio breviore*, i. 22, t. 22.

EXPLANATION OF THE PLATE.

PLATE CCCCXXXI. QUERCUS BREVIFOLIA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A nut, natural size.
6. A leaf, natural size.
7. A leaf, natural size.
8. A leaf, natural size.
9. A winter branchlet, natural size.



C.E.Faxon del. *Rapine sc.*

QUERCUS BREVIFOLIA, Sarg.

A.Riocreux direx.t *Imp. J.Taneur, Paris.*

QUERCUS IMBBRICARIA.

Shingle Oak. Laurel Oak.

LEAVES oblong-lanceolate or oblong-obovate, usually entire, pubescent on the lower surface.

Quercus imbricaria, Michaux, *Hist. Chênes Am.* No. 9, t. 15, 16 (1801); *Fl. Bor.-Am.* ii. 197. —Willdenow, *Spec.* iv. pt. i. 428; *Berl. Baumz.* ed. 2, 338; *Enum.* Suppl. 64. — Persoon, *Syn.* ii. 567. — Poiret, *Lam. Dict.* Suppl. ii. 214. — Michaux f. *Hist. Arb. Am.* ii. 78, t. 13. — Pursh, *Fl. Am. Sept.* ii. 627. — Nuttall, *Gen.* ii. 214. — *Nouveau Duhamel*, vii. 154. — Hayne, *Dendr. Fl.* 155. — Elliott, *Sk.* ii. 598. — Sprengel, *Syst.* iii. 857. — Dietrich, *Syn.* v. 306. — Brendel, *Trans. Ill. Agric. Soc.* iii. 623, t. 6. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 36. — Chapman, *Fl.* 420. — A. de Candolle, *Prodr.* xvi. pt. ii. 63. — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 73; *Liebmann Chênes Am. Trop.* t. D, t. xxii. f. 5. — Westmael, *Bull. Féd. Hort. Soc. Belg.* 1869, 349, t. 17. — Vasey, *Am. Ent. and Bot.* ii. 312, f. 196. — Koch, *Dendr.* ii. pt. ii. 60. — Lauche, *Deutsche Dendr.* 296. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 154. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 182. — Watson & Coulter, *Gray's Man.* ed. 6, 478. — Mayr, *Wald. Nordam.* 150, t. 1, 2. — Dippel, *Handb. Laubholzk.* ii. 103, f. 46. — Koehne, *Deutsche Dendr.* 131.

Quercus Phellos, *β* **imbricaria**, Spach, *Hist. Vég.* xi. 160 (1842).

Quercus imbricaria, *β* **spinulosa**, A. de Candolle, *Prodr.* xvi. pt. ii. 63 (1864).

A tree, usually fifty or sixty feet in height, with a trunk rarely exceeding three feet in diameter, or occasionally on low rich ground a hundred feet in height, with a stem clear of branches for fifty or sixty feet and from three to four feet in diameter. In its youth the Shingle Oak, unless greatly crowded by other trees, forms with tough slender horizontal or somewhat pendulous branches a broad pyramid tapering gradually from near the ground, and in old age a narrow round-topped open picturesque head. The bark on young stems and on their branches is thin, light brown, smooth and lustrous, and on old trunks it is from three quarters of an inch to an inch and a half in thickness, and slightly divided by irregular shallow fissures into broad ridges covered with thick closely appressed light brown scales somewhat tinged with red. The branchlets are slender, marked with pale lenticels, puberulous and dark green and lustrous at first and often suffused with red, but they soon become glabrous, and during their first winter are rather light reddish brown or light brown, growing dark brown in their second year. The winter-buds are ovate, acute, about an eighth of an inch long, obscurely angled and covered with closely imbricated light chestnut-brown lustrous scales erose and often ciliate on the scarious margins. The leaves are involute in the bud, oblong-lanceolate or oblong-obovate, gradually narrowed and wedge-shaped or rounded at the base, apiculate and acute or rounded at the apex, and entire, with slightly thickened and revolute often undulate margins, or they are sometimes broader and more or less three-lobed, or on vigorous sterile branches occasionally irregularly repand-lobulate; when they first unfold they stand at nearly right angles with the stem and are bright red, soon becoming light yellow-green and covered with scurfy rusty pubescence on the upper surface, and on the lower with thick hoary tomentum; and at maturity they are thin but firm in texture, glabrous, dark green and very lustrous above, pale green or light brown below and coated with soft fine pubescence, from four to six inches long and from three quarters of an inch to two inches wide, with stout yellow midribs broad and grooved on the upper side, numerous slender yellow veins arcuate and united at some distance from the margins, and fine reticulate veinlets; they are borne on stout pubescent petioles flattened and grooved above and rarely more than half an inch in length, and late in the autumn before falling the upper surface resembles dark red leather, while the lower remains pale, and the beauty of the leaf is heightened by the darker and more brilliantly colored midribs. The stipules are oblong-obovate to lanceolate,

acute, scarious, from one half to two thirds of an inch long, and caducous. The flowers open in April and May when the leaves are about one third grown, the staminate borne in the axils of linear lanceolate scarious caducous bracts on hoary tomentose aments two or three inches in length, and the pistillate on slender tomentose peduncles.[1] The calyx of the staminate flower is light yellow, pubescent and divided into four acute segments; the stamens number four or five, with oblong emarginate and slightly apiculate glabrous yellow anthers. The involucral scales of the pistillate flower are about as long as the acute calyx-lobes and are coated with pale pubescence; the stigmas are short, reflexed, and usually greenish yellow. The fruit, which ripens during the autumn of the second year, is solitary or in pairs and is borne on a stout peduncle sometimes nearly half an inch long; the nut is nearly as broad as it is long, full and rounded at the base, gradually narrowed but full and rounded at the apex, dark chestnut-brown, often obscurely striate, and from one half to two thirds of an inch in length, with a thin shell lined with rusty tomentum, and dark orange-brown cotyledons; the cup, which embraces from one third to one half of the nut, is thin, cup-shaped or turbinate, bright red-brown and lustrous on the inner surface, and covered by thin ovate light red-brown scales rounded or acute at the apex and coated with pale pubescence except on their darker colored margins.

Quercus imbricaria is distributed from Lehigh County, Pennsylvania, westward through southern Michigan and Wisconsin to northern Missouri[2] and northeastern Kansas,[3] and southward to the District of Columbia,[4] along the Alleghany Mountains, which it ascends to elevations of about four thousand feet, to northern Georgia and Alabama and to middle Tennessee and northern Arkansas.[5] It inhabits rich uplands and occasionally the fertile bottom-lands of rivers, and, comparatively rare in the east, is one of the most abundant Oaks of the basin of the lower Ohio, growing probably to its largest size in southern Indiana and Illinois.[6] Trees which are believed to be hybrids between *Quercus imbricaria* and *Quercus Marilandica*,[7] *Quercus velutina*,[8] and *Quercus palustris*[9] have been observed.

[1] On a young tree in the Arnold Arboretum the pistillate flowers are occasionally scattered at the base of the staminate aments.

[2] Broadhead, *Bot. Gazette*, iii. 60.

[3] Mason, *Eighth Bienn. Rep. State Board Agric. Kansas*, 272.

[4] L. F. Ward, *Bull. U. S. Nat. Mus.* No. 22, 113 (*Fl. Washington*).

[5] Harvey, *Am. Jour. Forestry*, i. 454.

[6] Ridgway, *Proc. U. S. Nat. Herb.* v. 80.

[7] *Quercus imbricaria* × *Marilandica*.

Quercus nigra, β *tridentata*, A. de Candolle, *Prodr.* xvi. pt. ii. 64 (1864).

Quercus imbricaria × *nigra*, Engelmann, *Trans. St. Louis Acad.* iii. 539 (1877).

A small tree (Plate ccccxxxiii.) found by Dr. Engelmann eight miles west of St. Louis in the autumn of 1849, and soon afterwards destroyed, was believed by him to be a hybrid between the Shingle Oak and the Black Jack. The leaves were elliptical to obovate in outline, entire or three-toothed or lobed at the apex and occasionally furnished with lateral teeth, rounded or acute at the base, dark green and lustrous above, pale and glabrate below, from four to seven inches long and from two to three inches broad. The fruit was sessile with a globose nut inclosed to the middle in a hemispherical turbinate cup covered by thin rather closely imbricated scales clothed with canescent pubescence. A number of trees with similar foliage have been found by Mr. George W. Letterman near Allenton, Missouri; shoots of *Quercus imbricaria* with large obovate three-toothed leaves were collected at Lancaster, Pennsylvania, by Mr. John K. Small, in August, 1890; and it is not improbable that all these individuals are extreme forms of *Quercus imbricaria* rather than hybrids, as this species shows a strong tendency to leaf and cup variation.

[8] *Quercus imbricaria* × *velutina*.

Quercus Leana, Nuttall, *Sylva*, i. 13*, t. 5 bis (1842). — Lea, *Cat. Pl. Cincinnati*, 30. — A. de Candolle, *l. c.* 62. — L. F. Ward, *Field and Forest*, i. 41; *Bot. Gazette*, v. 123; *Bull. U. S. Nat. Mus.* No. 22, 114 (*Fl. Washington*). — Sargent, *Garden and Forest*, ii. 471.

Quercus imbricaria × *coccinea*, Engelmann, *l. c.* (1877).

This peculiar tree (Plate ccccxxxiv.) was discovered near Cincinnati, Ohio, sixty or seventy years ago by Mr. Thomas G. Lea, and has since been found, usually in solitary specimens, in widely separated localities from the District of Columbia and the banks of the Tuckasegee and of the Tennessee in western North Carolina to southern Michigan, central and northern Illinois and southeastern Missouri. The winter-buds are acute, puberulous, and about half an inch long. The leaves are convolute in the bud, from oblong-obovate to lanceolate, entire, sinuate-dentate or dentate-lobed with acute or rounded bristle-tipped lobes acute or rounded or broad and slightly three-lobed at the apex and gradually narrowed and wedge-shaped or rounded at the base; when they unfold they are scurfy-pubescent on the upper surface, and coated on the lower with thick pale tomentum, and at maturity are thick and firm, dark green and lustrous above and rusty brown and puberulous below, from four to six inches long and from two to three inches wide, with slender midribs and primary veins, and slender petioles from one to two inches in length. The fruit is subsessile or is borne on a stout peduncle rarely half an inch long and is usually solitary; the nut is oblong, full and rounded at both ends or subglobose, and is inclosed nearly to the middle in the turbinate hemispherical cup covered by ovate loosely imbricated pubescent light red-brown scales. Some individual leaves of this tree are not distinguishable from those of *Quercus imbricaria*, which it resembles in habit and general appearance, but the cup is that of *Quercus velutina*.

[9] *Quercus imbricaria* × *palustris*, Engelmann, *l. c.*

A single small tree noticed by Dr. Engelmann near St. Louis in

The wood of *Quercus imbricaria* is heavy and hard but rather coarse-grained, and checks badly in drying; it is light brown tinged with red, with thin lighter colored sapwood, and contains broad conspicuous medullary rays and wide bands of large open ducts marking the layers of annual growth. The specific gravity of the absolutely dry wood is 0.7529, a cubic foot weighing 46.92 pounds. It is occasionally used in construction and for clapboards and shingles.

Quercus imbricaria was first described by André Michaux, who found it among the southern Alleghany Mountains toward the end of the last century, although, according to Aiton,[1] it had been introduced into English gardens by John Fraser [2] in the year when Michaux first visited the mountains of Carolina.

Quercus imbricaria, with its symmetrical habit, smooth bark, and lustrous dark green entire leaves, is one of the most beautiful of the American Oaks and a most distinct and desirable ornament of the parks and gardens of eastern America, where it is perfectly hardy as far north at least as the shores of Massachusetts Bay.

1870, and afterwards destroyed, was believed by him to be a hybrid between *Quercus imbricaria* and *Quercus palustris*. (See Braun, *Sitz. Gesell. Nat. Fr. Berlin*, 1870, 82.) The leaves were broadly lanceolate, mostly acute at the apex, and entire or usually furnished with coarse triangular-toothed acute bristle-pointed teeth; they were pubescent at first especially on the lower surface but soon became glabrate, and at maturity were thin, dark green and lustrous above, paler below, from four to six inches long and from one to two inches wide. The fruit was mostly solitary and was borne on a stout peduncle sometimes half an inch in length; the nut was oblong, full and rounded at the apex, almost as broad as it was long, light brown, and inclosed for about one third of its length in the thin cup-shaped or turbinate cup covered by ovate scales rounded at the apex and clothed, except on the bright red-brown margins, with hoary pubescence.

[1] *Hort. Kew.* ed. 2, v. 288. — Loudon, *Arb. Brit.* iii. 1898, f. 1777.

[2] See i. 8.

EXPLANATION OF THE PLATES.

Plate CCCCXXXII. Quercus imbricaria.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A fruit, natural size.
6. A leaf, natural size.
7. A leaf, natural size.
8. A winter branchlet, natural size.

Plate CCCCXXXIII. Quercus imbricaria × Marilandica.

1. A fruiting branch, natural size.

Plate CCCCXXXIV. Quercus imbricaria × velutina.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.

C. E. Faxon del. *Toulet sc.*

QUERCUS IMBRICARIA, Michx.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

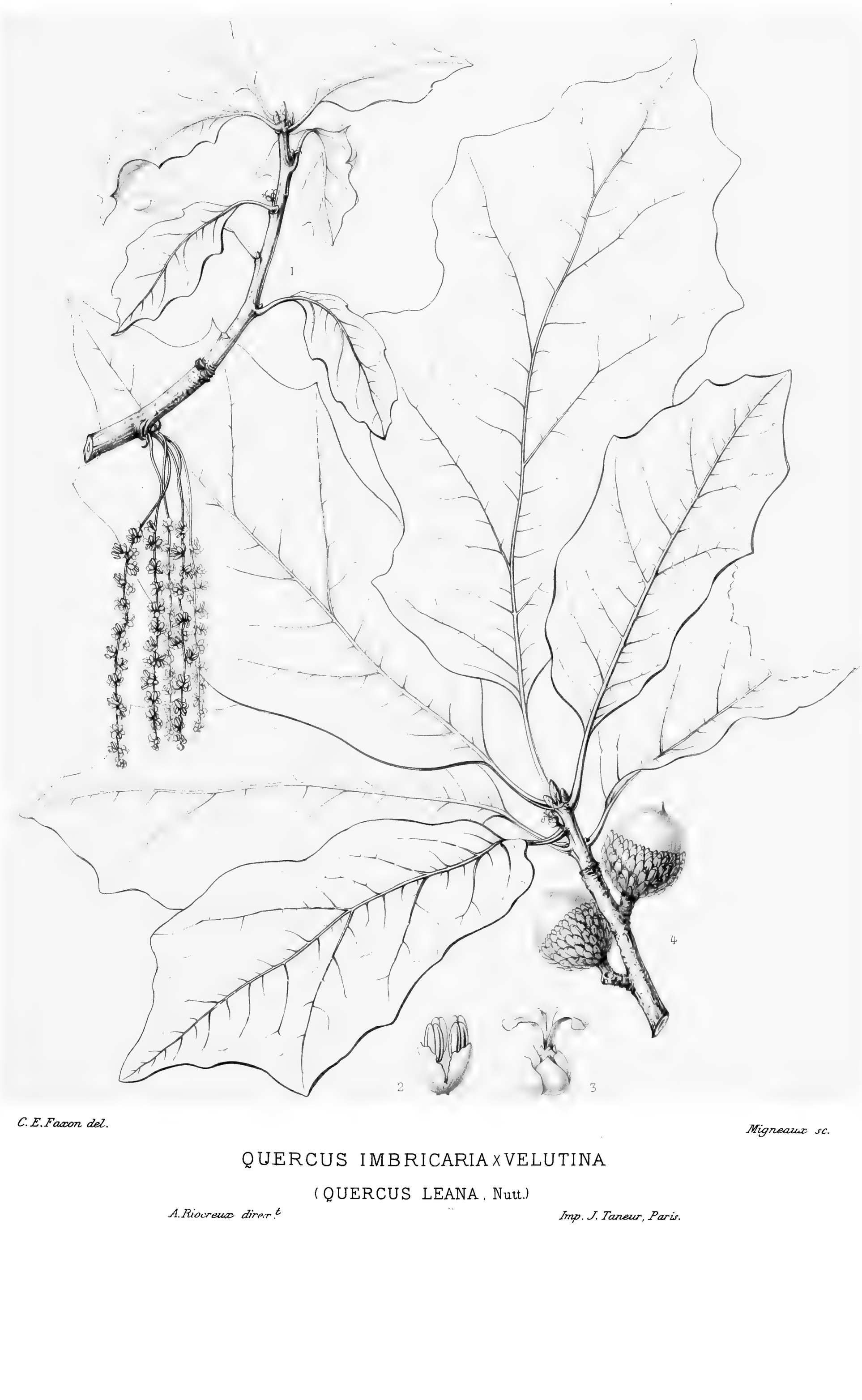
C. E. Faxon del.

Himely sc.

QUERCUS IMBRICARIA x MARILANDICA.

A. Riocreux direx.t

Imp. J. Taneur, Paris.



C. E. Faxon del.

Migneaux sc.

QUERCUS IMBRICARIA x VELUTINA

(QUERCUS LEANA, Nutt.)

A. Riocreux direx.t

Imp. J. Taneur, Paris.

QUERCUS PHELLOS.

Willow Oak.

LEAVES linear-lanceolate, narrowed at both ends, glabrous, usually entire.

Quercus Phellos, Linnæus, *Spec.* 994 (excl. vars.) (1753). — Miller, *Dict.* ed. 8, No. 12. — Muenchhausen, *Hausv.* v. 254 (excl. c). — Du Roi, *Harbk. Baumz.* ii. 278. — Wangenheim, *Beschrieb. Nordam. Holz.* 132; *Nordam. Holz.* 76, t. 5, f. 11. — Evelyn, *Silva*, ed. Hunter, i. 70. — Schoepf, *Mat. Med. Amer.* 137. — Walter, *Fl. Car.* 234. — Willdenow, *Spec.* iv. pt. i. 423; *Enum.* 974; *Berl. Baumz.* ed. 2, 337. — Persoon, *Syn.* ii. 567. — Desfontaines, *Hist. Arb.* ii. 507. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 424. — Michaux f. *Hist. Arb. Am.* ii. 74, t. 12. — Pursh, *Fl. Am. Sept.* ii. 625 (excl. var. β). — Nuttall, *Gen.* ii. 214. — *Nouveau Duhamel*, vii. 150. — Hayne, *Dendr. Fl.* 155. — Elliott, *Sk.* ii. 593. — Sprengel, *Syst.* iii. 857. — Spach, *Hist. Vég.* xi. 160 (excl. vars.). — Torrey, *Fl. N. Y.* ii. 187, t. 104. — Dietrich, *Syn.* v. 306. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 36. — Chapman, *Fl.* 420. — A. de Candolle, *Prodr.* xvi. pt. ii. 63 (excl. var. β). — Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 73. — Wesmael, *Bull. Féd. Soc. Hort. Belg.* 1869, 348, t. 15, 16. — Vasey, *Am. Ent. and Bot.* ii. 311, f. 195. — Koch, *Dendr.* ii. pt. ii. 59. — *Gartenflora*, xxix. 221, f. — Lauche, *Deutsche Dendr.* 296. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 154. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 181 (excl. vars.). — Houba, *Chênes Am. en Belgique*, 212, t. — Watson & Coulter, *Gray's Man.* ed. 6, 479. — Mayr, *Wald. Nordam.* 150, t. 2. — Koehne, *Deutsche Dendr.* 131. — Dippel, *Handb. Laubholzk.* ii. 106, f. 48, 49. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 417 (*Man. Pl. W. Texas*).

Quercus Phellos, α **longifolia**, Lamarck, *Dict.* i. 722 (1783).

Quercus Phellos, δ **subrepanda**, Lamarck, *Dict.* i. 722 (1783).

Quercus Phellos, ε **sublobata**, Lamarck, *Dict.* i. 722 (1783).

Quercus Phellos, α **viridis**, Aiton, *Hort. Kew.* iii. 354 (1789).

Quercus Phellos (**sylvatica**), Michaux, *Hist. Chênes Am.* No. 7, t. 12 (1801); *Fl. Bor.-Am.* ii. 197.

A tree, occasionally seventy or eighty feet in height, with a trunk two or three or rarely four feet in diameter, but usually much smaller, and slender branches spreading gradually into a comparatively narrow open or conical round-topped head. The bark of the trunk is from one half to three quarters of an inch in thickness, light reddish brown slightly tinged with red, and generally smooth but broken on old trees by shallow narrow fissures into irregular plates covered with small closely appressed scales. The branchlets are slender, roughened with dark lenticels, glabrous and reddish brown, and in their second year grow dark brown tinged with red or grayish brown. The winter-buds are ovate, acute, about an eighth of an inch long, and covered by dark chestnut-brown scales, with pale scarious margins. The leaves are involute in the bud, ovate-lanceolate or rarely lanceolate-obovate, often somewhat falcate, gradually narrowed and acute at the base, acute and apiculate at the apex, and entire with slightly undulate margins; when they unfold they are light yellow-green and lustrous on the upper surface, and coated on the lower with pale caducous pubescence, and at maturity are glabrous, light green and rather lustrous above, dull and paler, or rarely coated with hoary pubescence below,[1] conspicuously reticulate-venulose, from two and a half to five inches in length and from a quarter of an inch to an inch in width, with slender yellow midribs raised and rounded on the upper side and obscure primary veins forked and united about half way between the midribs and the margins; they are borne on stout grooved petioles from one eighth to one quarter of an inch in length and turn pale yellow in the autumn before falling. The flowers open when the leaves are about a quarter grown, the staminate borne in hairy slender-stemmed aments from two to three inches in length and the pistillate on slender glabrous peduncles. The calyx of the staminate flower is yellow and hairy, and is divided into four or five ovate acute segments; the stamens are four or five in number, with oblong glabrous

[1] I have seen this form only on a specimen collected near Wilmington, Delaware, by Mr. W. M. Canby, and preserved in the Gray Herbarium.

yellow slightly apiculate anthers. The involucral scales of the pistillate flower are brown and covered with pale hairs, and about as long as the acute calyx-lobes; the stigmas are much reflexed and bright red. The fruit ripens in the autumn of the second year and is short-stalked or nearly sessile, and solitary or sometimes in pairs; the nut is hemispherical, half an inch in diameter, light yellow-brown, and coated with pale pubescence; the cup, which embraces only the base of the nut, is thin, saucer-shaped or subturbinate, light reddish brown, clothed with lustrous silky pubescence on the inner surface, and covered by thin elongated ovate truncate hoary pubescent scales dark red-brown on their margins.

The Willow Oak inhabits the low wet borders of swamps and streams and rich sandy uplands, and is distributed from Tottenville, Staten Island, New York, to northeastern Florida, through the Gulf states to the valley of the Sabine River in Texas, and through Arkansas to southeastern Missouri, central Tennessee, and southern Kentucky.[1] Usually confined in the Atlantic states to the low maritime plain, without, however, approaching close to the seacoast, it is less common in the middle districts, and rarely ranges to the Appalachian foothills.

Trees believed to be hybrids between *Quercus Phellos* and *Quercus velutina*,[2] and between

[1] The occurrence of *Quercus Phellos* in Schuyler County, western Illinois, is mentioned by Worthen (*Geology of Illinois*, i. 443), but I have seen no specimens of this species from the region north of the Ohio River. (See Ridgway, *Proc. U. S. Nat. Mus.* v. 83; *Bot. Gazette*, viii. 349.)

[2] *Quercus Phellos* × *velutina* (Plate ccccxxxvi.).

Quercus heterophylla, Michaux f. *Hist. Arb. Am.* ii. 87, t. 16 (1812). — Pursh, *Fl. Am. Sept.* ii. 627. — Barton, *Compend. Fl. Phil.* ii. 167. — Nuttall, *Gen.* ii. 214; *Sylva*, i. 15. — Loudon, *Arb. Brit.* iii. 1894. — Gale, *Proc. Nat. Inst.* 1855, 70, f. 1. — Buckley, *Proc. Phil. Acad.* 1861, 361; 1862, 100. — Örsted, *Chênes Am. Trop.* t. B. — Koch, *Dendr.* ii. pt. ii. 62. — Meehan, *Proc. Phil. Acad.* 1875, 437, 465; *Bot. Gazette*, vii. 10. — Leidy, *Proc. Phil. Acad.* 1875, 415. — Martindale, *Notes on the Bartram Oak*, 3; *Bot. Gazette*, vi. 303. — L. F. Ward, *Bull. U. S. Nat. Mus.* No. 22, 114 (*Fl. Washington*). — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 153. — Houba, *Chênes Am. en Belgique*, 224, t. — Mayr, *Wald. Nordam.* 150. — Dippel, *Handb. Laubholzk.* ii. 108. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 417 (*Man. Pl. W. Texas*).

Quercus aquatica, β *heterophylla*, Aiton, *Hort. Kew.* ed. 2, v. 290 (1813). — A. de Candolle, *Prodr.* xvi. pt. ii. 68.

Quercus nigra, var., Cooper, *Smithsonian Rep.* 1858, 255 (1859).

Quercus Phellos × *tinctoria*, Gray, *Man.* ed. 4, 406 (1863).

Quercus Phellos, var., Gray, *l. c.* ed. 5, 453 (1867).

Quercus Phellos × *coccinea*, Engelmann, *Trans. St. Louis Acad.* iii. 541 (1877). — Watson & Coulter, *Gray's Man.* ed. 6, 479 (× *rubra?*).

A specimen of this peculiar tree, growing in a field belonging to John Bartram on the Schuylkill, near Philadelphia, was first described by the younger Michaux in 1812, although it appears to have been known much earlier, as "that particular species of Oak that Dr. Mitchell found in thy meadow," seeds of which Peter Collinson asked from "my good friend John" in March, 1750, was probably this tree. (See Darlington, *Memorials of Bartram and Marshall*, 183.) It was destroyed long ago, but a seedling from it which was planted by Humphry Marshall in his arboretum at Marshallton more than a century since still survives, and offsprings of Bartram's tree have also been grown in Europe. About twenty-five years ago several individuals of apparently the same parentage were found in the woods on both banks of the Delaware east of Camden, New Jersey, and others were subsequently discovered near Wilmington, Delaware, on Staten Island, New York, in the District of Columbia, in western North Carolina, northern Alabama, and near Houston, Texas.

These trees are usually thirty or forty feet high, with trunks eighteen or twenty inches in diameter, although the specimen in Marshall's arboretum is nearly twice this size; the bark is from three quarters of an inch to an inch in thickness, gray or light brown tinged with red, smooth and covered with small closely appressed scales. The branchlets are slender, marked with pale lenticels, and tomentose at first, but soon become glabrous and turn bright red-brown during their first winter and ultimately dark brown. The winter-buds are ovate, acute, slightly angled, rather more than an eighth of an inch long, and covered with light red-brown scales scarious on the margins, glabrous on some individuals and pilose or pubescent on others. The leaves are revolute in the bud, lanceolate or oblong-obovate in outline, entire, sinuately spinulose-dentate, coarsely serrate, or lobed with spreading or falcate acute entire bristle-pointed lobes, the different forms appearing on the same tree and on the same branch, the leaves on upper branches, however, being usually entire; when they unfold they are pubescent on the upper surface and tomentose on the lower, and at maturity are dark green and lustrous above and rusty brown below, and glabrous with the exception of occasional tufts of hairs in the axils of the veins on the lower surface. The flowers open when the leaves are about a third grown, the staminate borne in hairy aments from two to three inches in length, and the pistillate on short tomentose peduncles. The calyx of the staminate flower is hairy on the outer surface and is generally divided into four ovate acute lobes; the stamens are four or five in number, with ovate acute slightly apiculate anthers. The involucral scales of the pistillate flower are covered with pale hairs and are rather shorter than the acute calyx-lobes; the stigmas are reflexed and dark red. The fruit, which is produced sparingly, ripens in the autumn of the second year and is sessile or short-stalked; the nut is oval to subglobose, half an inch long, light yellow or reddish brown, and puberulous; the cup, which incloses nearly half the nut, is thin, turbinate or almost hemispherical, light red-brown, pubescent on the inner surface, and covered by elongated rather loosely imbricated acute scales coated with hoary tomentum. On trees discovered by Mr. Arthur Hollick at Tottenville, Staten Island, New York, in 1888 (*Quercus Phellos* × *rubra*, *Bull. Torrey Bot. Club*, xv. 303, t. 84, 85), the more oblong fruit and the shallower cups, with less tomentose scales glabrous and bright red on their margins, indicate perhaps, as he suggested, the influence of *Quercus rubra*, although the leaves do not differ from those on trees one of whose parents was evidently *Quercus velutina*.

Quercus Phellos and *Quercus Marilandica*,[1] have been repeatedly found, and the species apparently crosses also with *Quercus nana*.[2]

The wood of *Qucrcus Phellos* is heavy and strong, although not hard, rather coarse-grained, and light brown tinged with red, with thin lighter colored sapwood, and contains thin medullary rays and bands of several rows of small open ducts marking the layers of annual growth. The specific gravity of the absolutely dry wood is 0.7472, a cubic foot weighing 46.56 pounds. It is occasionally used in construction, for clapboards, and for the fellies of wheels.

An Oak-tree with narrow entire leaves seemed a remarkable object to Europeans of the seventeenth century, and the Willow Oak attracted the attention of some of the earliest botanical explorers of eastern America. It was included in the catalogue of Virginia plants which John Banister sent to England in 1680,[3] and was first described by Ray in the third volume of the *Historia Plantarum*, published in 1704.[4] According to Aiton [5] it was in cultivation in England in 1724.

A distinct and beautiful, fast-growing, hardy tree, the Willow Oak,[6] although admirably suited to embellish the parks and gardens of eastern North America, is rarely cultivated in the northern states. Associated with the Water Oaks, it may sometimes be seen shading the streets of southern towns and in European plantations.[7]

[1] *Quercus Phellos* × *Marilandica.*

Quercus Phellos, β *subimbricaria*, A. de Candolle, *Prodr.* xvi. pt. ii. 63 (1864).

Quercus Rudkini (*Quercus Phellos* × *nigra*), Britton, *Bull. Torrey Bot. Club*, ix. 13, t. 10–12, figs. 1–5 (1882).

First distinguished as a hybrid in 1881 between Keyport and South Amboy, New Jersey, where a number of individuals were seen by W. H. Rudkin and W. Bower, this peculiar tree is now thought to be comparatively common on Staten Island and in southern New Jersey. The leaves vary in outline from ovate-lanceolate to oblong-oval and to broadly obovate, and are entire or furnished with one or more irregular lateral lobes, or are three-lobed at the apex with acute lobes, or repand-dentate at the broad apex, or sinuate-lobed with wide or narrow sinuses, the different forms appearing on the same tree and sometimes on the same branch ; they are from three to five inches in length, and from one to three inches in width, and thick and rather firm in texture, and are sometimes glabrous on the lower surface, like the leaves of *Quercus Phellos*, but more frequently are covered below with the rusty pubescence of *Quercus Marilandica*. The nuts vary on different trees from subglobose to ovate-acute, and are inclosed at the base only or for more than half their length in shallow saucer-shaped, cup-shaped, or turbinate cups with rather loosely imbricated ovate acute scales clothed, except on their dark red-brown margins, with pale tomentum. A tree, probably of similar parentage, was found by Mr. J. K. Small at the falls of the Yadkin River in North Carolina, in August, 1892 ; and one found by Mr. Ravenel near Aiken, South Carolina, is believed to have had the same origin by Dr. Britton, who considers that all trees in New Jersey and on Staten Island which have been referred to *Quercus imbricaria* are hybrids of this parentage.

[2] Specimens of an Oak without fruit collected at May's Landing, New Jersey, by Mr. J. C. Gifford and Mr. J. E. Peters in July, 1890 (*Quercus Phellos* × *ilicifolia*, Peters, *Bull. Torrey Bot. Club*, xx. 295), with oblong-ovate acute apiculate leaves entire or furnished with a large lateral acute or rounded lobe, silvery white and pubescent on the lower surface, four or five inches long and from an inch and a half to two inches wide, have every appearance of belonging to a hybrid between *Quercus Phellos* and *Quercus nana*.

[3] *Quercus Lini aut Salicis foliis*, Ray, *Hist. Pl.* ii. 1927.

[4] *Quercus, an potius Ilex Marilandica folio longo angusto Salicis*, iii. *Dendr.* 8. — Catesby, *Nat. Hist. Car.* i. 16, t. 16. — Charlevoix, *Histoire de la Nouvelle France*, ed. 12mo, iv. 333, f. 41.

Quercus foliis lanceolatis integerrimis, Clayton, *Fl. Virgin.* 117.

Quercus folio longo angusto salicis, Romans, *Nat. Hist. Florida*, 25.

[5] *Hort. Kew.* iii. 354. — Loudon, *Arb. Brit.* iii. 1894, f. 1774, t.

[6] In Arkansas the Willow Oak is sometimes called Water Oak and Pin Oak (Harvey, *Am. Jour. Forestry*, i. 454).

[7] Nicholson, *Garden and Forest*, i. 136. — J. G. Jack, *Garden and Forest*, v. 602.

EXPLANATION OF THE PLATES.

Plate CCCCXXXV. Quercus Phellos.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A leaf from a young vigorous shoot, natural size.
6. A winter branchlet, natural size.

Plate CCCCXXXVI. Quercus Phellos × velutina (Quercus heterophylla).

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. A winter branchlet, natural size.

Plate CCCCXXXVII. Quercus Phellos × Marilandica (Quercus Rudkini).

1. A fruiting branch, natural size.
2. A leaf, natural size.
3. A leaf, natural size.
4. A leaf, natural size.

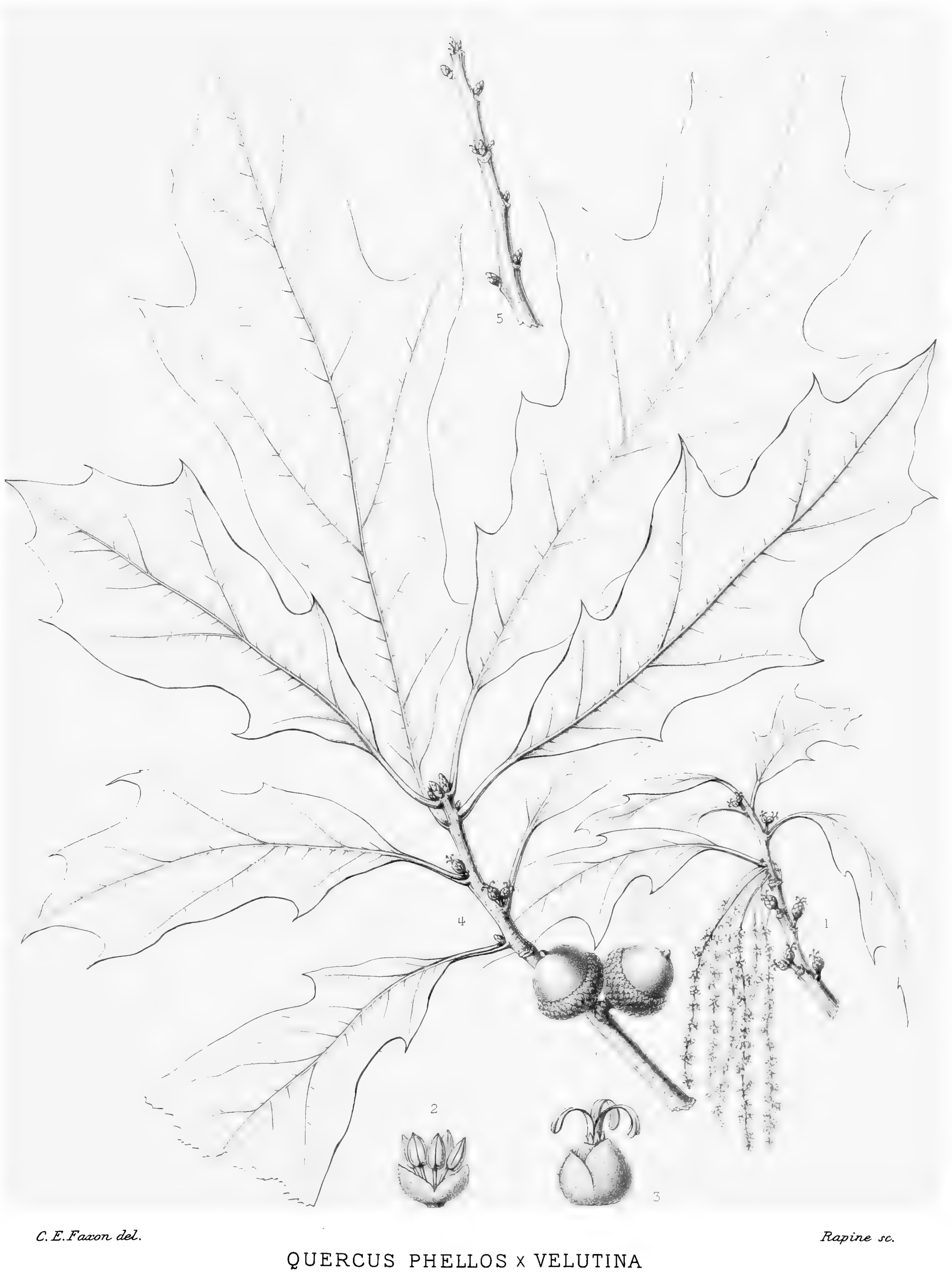
C.E.Faxon del.

Himely sc.

QUERCUS PHELLOS, L.

A. Riocreux direx.t

Imp. J. Taneur, Paris.



C. E. Faxon del. *Rapine sc.*

QUERCUS PHELLOS x VELUTINA

(QUERCUS HETEROPHYLLA, Michx.f.)

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

C.E.Faxon del. *Himely sc.*

QUERCUS PHELLOS x MARILANDICA

(QUERCUS RUDKINI, Britt.)

A.Riocreux direx.t *Imp. J.Taneur, Paris.*

QUERCUS DENSIFLORA.

Tan Bark Oak. Chestnut Oak.

LEAVES oblong, entire or dentate, tomentose on the lower surface, persistent.

Quercus densiflora, Hooker & Arnott, *Bot. Voy. Beechey*, 391 (1849). — Hooker, *Icon.* iv. t. 380. — Nuttall, *Sylva*, i. 11, t. 5. — Torrey, *Pacific R. R. Rep.* iv. pt. i. 138; *Bot. Wilkes Explor. Exped.* 458. — Bentham, *Pl. Hartweg.* 337. — Newberry, *Pacific R. R. Rep.* vi. 31, 89, f. 8. — A. de Candolle, *Prodr.* xvi. pt. ii. 82. — Bolander, *Proc. Cal. Acad.* iii. 231. — Engelmann, *Trans. St. Louis Acad.* iii. 380; *Brewer & Watson Bot. Cal.* ii. 99. — Kellogg, *Forest Trees of California*, 85. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 155. — Wenzig, *Jahrb. Bot. Gart. Berlin*, iii. 219. — Greene, *West Am. Oaks*, 41, t. 23; *Man. Bot. Bay Region*, 303. — Mayr, *Wald. Nordam.* 263, t. 2, 5.

Quercus echinacea, Torrey, *Pacific R. R. Rep.* iv. pt. i. 137, t. 14 (1856).

Pasania densiflora, Örsted, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1866, 83; *Liebmann Chênes Am. Trop.* 21.

The Tan Bark Oak is usually seventy or eighty but sometimes nearly one hundred feet in height, and although its trunk generally does not exceed three feet in diameter, individuals with stems double that size occasionally occur; on trees in dense coniferous forests the stout branches ascend and form a narrow spire-like top, or in more open positions and when space permits, the lower branches spread horizontally, and the head is broad, symmetrical, dense, and round-topped; or sometimes it is reduced to a shrub with slender stems only a few feet high.[1] The bark of the trunk is from three quarters of an inch to an inch and a half in thickness, and is deeply divided by narrow fissures into broad rounded ridges broken transversely into nearly square plates covered with closely appressed light reddish brown scales. The branchlets are stout, covered with minute pale lenticels, and coated at first with thick fulvous tomentum of stellate hairs which often does not entirely disappear until the second or third years, when they are dark reddish brown and frequently covered with a glacous bloom. The winter-buds are ovate, obtuse, from one quarter to one third of an inch in length, covered with tomentose loosely imbricated scales, and often surrounded by the persistent stipules of the upper leaves; the scales are linear-lanceolate in the outer ranks, but increasing in width toward the interior of the bud, those of the inner ranks are ovate or obovate and rounded at the apex. The leaves are convolute in the bud and oblong or oblong-obovate, rounded or acute or rarely cordate at the base, acute or occasionally rounded at the apex, and repand-dentate with acute callous teeth, or entire, with thickened revolute margins, dentate and entire leaves often appearing on the same branch; when they unfold they are coated with fulvous tomentum and furnished on the margins with dark caducous glands, and when fully grown are pale green, lustrous and glabrous or more or less covered with scattered stellate pubescence on the upper surface, and coated on the lower with rusty tomentum, but ultimately become glabrous above and glabrate and bluish white below; they are from three to five inches long and from three quarters of an inch to three inches wide, with stout midribs raised and rounded on the upper side,

[1] *Quercus densiflora*, var. *echinoides*.

Quercus echinoides, R. Brown Campst. *Ann. and Mag. Nat. Hist.* ser. 4, vii. 251 (1871). — Greene, *Man. Bot. Bay Region*, 304.

Quercus densiflora, Greene, *West Am. Oaks*, t. 24 (1889).

This slender shrub (Plate ccccxxxviii. f. 9), apparently first noticed by Robert Brown on Cañon Creek in southern Oregon and said by him to ascend on the Siskiyou Mountains to elevations of eight thousand feet, is not rare on the slopes of Mt. Shasta or on the Sierra Nevada in northern California. The leaves are oval or oblong-obovate, narrowed at both ends or occasionally rounded at the apex, entire or obscurely sinuate-dentate, from an inch and a half to two inches in length and from one half to two thirds of an inch in width, glabrous above and hoary-pubescent below, with obscure midribs and primary veins. The nut is ovate, gradually narrowed and acute at the apex, nearly an inch long, and inclosed at the base in the cup-shaped cup covered by long slender recurved scales. Very distinct in the shape, size, and covering of its leaves from the large-leaved forms of *Quercus densiflora*, this shrub is connected with them by small trees which produce leaves intermediate in shape, dentation, size, and coloring. The fruit of the shrub differs from that of the tree only in its usually smaller size and less hairy cup-scales.

and thin or thick primary veins running obliquely to the points of the teeth, or in entire leaves usually forked and united near the margins, and connected by straight secondary veins and fine conspicuous reticulate veinlets; they are borne on stout rigid tomentose petioles from one half to three quarters of an inch in length and do not fall until the end of the third or sometimes not until the end of the fourth year. The stipules vary from oblong-obovate to linear-lanceolate, and are brown and scarious, coated on the outer surface, especially along the midribs, with long pale hairs, and caducous, or those of the last leaves are frequently persistent during the winter. The flowers usually appear in early spring and frequently also irregularly during the autumn and winter, and are borne in unisexual staminate and in androgynous aments which are produced from the axils of leaves of the year or from the inner scales of the terminal bud, or sometimes from separate buds in the axils of leaves of the previous year, and are erect, stout-stemmed, tomentose, and three or four inches in length. The staminate flowers are borne in three-flowered clusters crowded on the aments, covered before anthesis with thick hoary tomentum, and subtended by ovate rounded tomentose bracts, the two lateral flowers in the cluster being furnished with similar although smaller bracts; the calyx is tomentose and divided into five nearly triangular acute lobes; there are ten stamens with slender elongated filaments, small oblong emarginate anthers, minute pollen grains, and an acute hairy abortive ovary. The pistillate flowers, which are scattered at the base of the upper aments, are solitary in the axils of acute tomentose bracts, and are furnished with two acute bractlets; the ovary is ovate-oblong, slightly contracted below the six rounded calyx-lobes, coated like them with pale hairs, and inclosed in the tomentose involucral scales; at the base of each calyx-lobe is inserted a bright red stamen with a slender exserted filament and a minute abortive anther; the styles are elongated, slightly spreading, three in number, light green, and dark and stigmatic at the apex. The fruit, which ripens at the end of the second season, is solitary or often in pairs, and is borne on a stout tomentose peduncle from half an inch to nearly an inch in length; the nut is oval or ovate, full and rounded at the base, gradually narrowed and full and rounded or acute at the apex, coated when fully grown with scurfy pubescence, but glabrous light yellow-brown and lustrous at maturity, from three quarters of an inch to an inch and a half long and from half an inch to nearly an inch broad, with a thick hard shell lined with a thick coat of fulvous tomentum, a thick red-brown seed-coat, abortive ovules near the apex of the seed, and light yellow bitter cotyledons; the cup, which embraces only the base of the nut, is thin and woody, shallow and cup-shaped, tomentose with lustrous red-brown hairs on the inner surface, and covered by long linear rigid spreading or recurved light brown scales coated with pale stellate hairs, often tipped, especially while young, with dark red glands, and often clothed near the base of the cup with thick pale or fulvous tomentum.

Quercus densiflora is distributed from the valley of the Umpqua River in southern Oregon southward through the coast ranges to the Santa Inez Mountains[1] east of Santa Barbara, California, and along the western slopes of the Sierra Nevada, which it ascends to an elevation of four thousand feet above the level of the sea, to Mariposa County. Exceedingly abundant in the humid California coast region north of San Francisco Bay, the Tan Bark Oak grows to its largest size in the Redwood forests of Napa and Mendocino Counties; farther north and south, and on the Sierras, it is much less abundant and of smaller size.

The wood of *Quercus densiflora* is hard, strong, and close-grained but brittle; it is bright reddish brown, with very thick darker brown sapwood,[2] and contains broad bands of small open ducts parallel to the thin dark conspicuous medullary rays. The specific gravity of the absolutely dry wood is 0.6827, a cubic foot weighing 42.55 pounds. Of little value for construction, it is largely consumed as fuel.

The bark, which is exceedingly rich in tannin, is largely used for tanning leather,[3] and is preferred for this purpose to that of any other tree of the forests of Pacific North America.

[1] Barclay Hazard, *Erythea*, i. 159.

[2] The log specimen in the Jesup Collection of North American Woods in the American Museum of Natural History, New York, is eighteen inches in diameter inside the bark, with one hundred and twenty-seven layers of annual growth, of which one hundred and one are sapwood.

[3] The value of the bark has caused the destruction of most of the large specimens of *Quercus densiflora* in all accessible situa-

The only American representative of a peculiar group of Asiatic trees in which are combined the characters of the Oak and the Chestnut, *Quercus densiflora* is, from the point of view of botanical geography and botanical archæology, one of the most interesting inhabitants of the forests of the United States. No Oak-tree, moreover, of western North America excels the best representatives of this species in massive beauty,[1] in symmetry of outline, or in richness of color; and in early spring the elongated tender shoots and unfolding leaves coated with bright hairs, appearing like masses of flowers against the dark background of foliage, light up the dark coniferous forests where the Tan Bark Oak finds its most congenial home.

tions, but the shoots which spring profusely from the stumps and grow with remarkable vigor will prevent the extermination of the species.

[1] See *Garden and Forest*, v. 517, f. 89.

EXPLANATION OF THE PLATE.

PLATE CCCCXXXVIII. QUERCUS DENSIFLORA.

1. A flowering branch, natural size.
2. Diagram of a staminate inflorescence.
3. Diagram of a pistillate flower.
4. Portion of an androgynous ament, enlarged.
5. A staminate flower, enlarged.
6. A pistillate flower, enlarged.
7. A pistillate flower, the involucre removed, enlarged.
8. A fruiting branch, natural size.
9. A fruiting branch, natural size.
10. A leaf, natural size.
11. A winter-bud, enlarged.

C.E. Faxon del. *Rapine sc.*

QUERCUS DENSIFLORA, Hook. & Arn.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

INDEX TO VOL. VIII.

Names of Orders are in SMALL CAPITALS; of admitted Genera and Species and other proper names, in roman type; of synonyms, in *italics*.

Amphibolips spongifica, 12.
Androgyne, 4.
Anisota pellucida, 12.
Anisota senatoria, 12.
Anisota Stigma, 12.
Antheræa Roylei, 10.
Anthostoma atropunctata, 12.

Balaninus nascicus, 12.
Balaninus Quercus, 12.
Balaninus uniformis, 12.
Basket Oak, 67.
Bear Oak, 155.
Black Jack, 145, 161.
Black Jack, Fork-leaved, 145.
Black Oak, 103, 137, 141.
Blue Jack, 171.
Blue Oak, 79.
Borer, Flat-headed, 11.
Borers, Oak, 11.
Brewer, William Henry, 28.
Brewerina, 28.
Brown, Robert, 62.
Bur Oak, 43.

Castaneopsis, 4.
Cerris, 4.
Cerroides, 4.
Chestnut Oak, 51, 55, 183.
Chinquapin Oak, 56, 59.
Chionaspes Quercus, 11.
Chlamydobalanus, 4.
Chrysobothris femorata, 11.
Cicada septendecim, 11.
Cicada, The Seventeen-year, 11.
Clisiocampa Californica, 11.
Clisiocampa constricta, 11.
Clisiocampa disstria, 11.
Coccifera, 4.
Coccomyces triangularis, 13.
Coccus Ilicis, 10.
Cork, harvesting of, 8.
Cork Oak, 8.
Cossula magnifica, 11.
Cossus Querciperda, 11.
Cossus reticulatus, 11.
Cow Oak, 67.
Cryptolechia quercicella, 12.
Cryptolechia Schlagenella, 12.
CUPULIFERÆ, 1.
Cyclobalanopsis, 4.
Cyclobalanopsis, 1.
Cyclobalanus, 4.
Cyclobalanus, 1.
Cynips Gallæ tinctoriæ, 9.

Dædalia quercina, 12.
David's Oak, 10.
Duck Oak, 166.

Elaphidion villosum, 11.
Encina, 111.
Encleistocarpon, 4.
Engelmann, George, 84.
Engelmannia, 84.
Eriosma Querci, 11.
Erythrobalanos, 4.
Esculus, 4.
Eupsalis minuta, 11.
Evergreen White Oak, 83.

Fistulina Hepatica, 13.
Flat-headed Borer, 11.
Fork-leaved Black Jack, 145.
Fulham Oak, the, 7.

Gallifera, 4.
Gall insects on Quercus, 12.
Galls, Nut, 9.
Galls, Oak, 9.
Gambel, William, 35.
Gambelia, 35.
Germination of Quercus, 4.
Glœosporium Canadense, 12.
Greene, Edward Lee, 84.
Greenella, 84.
Gyrolecana, 4.

Hemileuca Maia, 12.
Hickory Oak, 107.
Hybrids of Quercus, 5.
Hyphantria cunea, 11.

Ilex, 4.

Jack, Black, 145, 161.
Jack, Blue, 171.
Jack Oak, 161.
Jack, Sand, 172.

Kellogg, Albert, 120.
Kelloggia, 120.
Kermes, the Oak, 10.

Laurel Oak, 175.
Leaf-miners on Quercus, 12.
Lecanium Quercifex, 11.
Lecanium Quercitronis, 11.
Lepidobalanus, 4.
Lepidobalanus, buds of, 4.
Leucobalanus, 4.
Liopus Querci, 11.
Lithocarpus, 4.
Lithocarpus, 1.
Live Oak, 99, 105, 111, 119.
Live Oak, U. S. reservations of, 101.
Lochmæus manteo, 12.
Lucombe Oak, the, 7.

Mallodon melanopus, 11.
Marshall, Humphry, 39.
Marshallia, 39.
Maul Oak, 105.
Melanobalanus, 4.
Mellichamp, Joseph Hinson, 144.
Mellichampia, 144.
Microsphæra quercina, 13.
Mossy Cup Oak, 43.
Mountain White Oak, 79.

Née, Louis, 25.
Neea, 25.
Nummularia Clypeus, 12.
Nummularia punctulata, 12.
Nut-galls, 9.

Oak-apple, 12.
Oak, Basket, 67.
Oak, Bear, 155.
Oak, Black, 103, 137, 141.
Oak, Blue, 79.
Oak, Bur, 43.
Oak, Chestnut, 51, 55, 183.
Oak, Chinquapin, 56, 59.
Oak, Cork, 8.
Oak, Cow, 67.
Oak, David's, 10.
Oak, Duck, 166.
Oak, Evergreen White, 83.
Oak galls, 9.
Oak, Hickory, 107.
Oak, Jack, 161.
Oak kermes, 10.
Oak, Laurel, 175.
Oak, Live, 99, 105, 111, 119.
Oak, Maul, 105.
Oak, Mossy Cup, 43.
Oak, Mountain White, 79.
Oak of Mamre, 10.
Oak, Overcup, 47.
Oak, Pin, 51, 56, 151, 181.
Oak, Possum, 166.
Oak, Post, 37.
Oak, Punk, 166.
Oak, Quercitron, 139.
Oak, Red, 125, 129.
Oak, Rock, 56.
Oak, Rock Chestnut, 51.
Oak, Running, 115.
Oak, Saul's, 18.
Oak, Scarlet, 129.

Oak, Scrub, 75, 95, 123, 145, 155.
Oak, Shin, 27, 33, 75.
Oak, Shingle, 175.
Oak, Spanish, 147.
Oak, Swamp Spanish, 151.
Oak, Swamp White, 47, 63.
Oak, Tan Bark, 183.
Oak, the Fulham, 7.
Oak, the Lucombe, 7.
Oak, the Wadsworth, 63.
Oak, Turkey, 143.
Oak, Upland Willow.
Oak, Valley, 23.
Oak, Valonia, 8.
Oak, Water, 165, 169, 181.
Oak, White, 16, 23, 29, 33, 71, 87, 89.
Oak, Willow, 179.
Oak, Yellow, 55, 127, 139.
Oak, Yellow-bark, 137.
Oaks, American, cultivated in Europe, 11.
Overcup Oak, 47.

Palmer, Edward, 106.
Palmerella, 106.
Pasania, 4.
Pasania, 1.
Pasania, buds of, 4.
Pasania densiflora, 183.
Phryganidia Californica, 11, 112.
Pin Oak, 51, 56, 151, 181.
Pityophthorus pubipennis, 11.
Pityophthorus querciperda, 11.
Polyporus graveolens, 13.
Possum Oak, 166.
Post Oak, 37.
Prionoxystus Robiniæ, 11.
Prionus laticollis, 11.
Punk Oak, 166.

Quercitron Oak, 139.
Quercus, 1.
Quercus acuminata, 55.
Quercus acuminata × macrocarpa, 56.
Quercus acuta, 4, 11.
Quercus acutidens, 95.
Quercus Ægilops, 3, 8.
Quercus Ægilops, 7.
Quercus Ægilops, β *macrolepis*, 8.
Quercus agrifolia, 111.
Quercus agrifolia, γ *berberifolia*, 111.
Quercus agrifolia, var. *frutescens*, 111.
Quercus alba, 16.
Quercus alba, hybrids of, 18.
Quercus alba, medical properties of, 3.
Quercus alba, α *pinnatifido-sinuata*, 16.
Quercus alba, β ? *Gunnisonii*, 33.
Quercus alba, β *sinuata*, 16.
Quercus alba, γ *microcarpa*, 16.
Quercus alba palustris, 63.
Quercus alba × macrocarpa, 18.
Quercus alba × minor, 18.
Quercus alba × Prinus, 18, 19.
Quercus alba minor, 37.
Quercus alba pinnatifida, 16.
Quercus alba (*repanda*), 16.
? *Quercus aliena*, 6.
Quercus ambigua, 125.
Quercus annulata, 71.
Quercus aquatica, 165.
Quercus aquatica, α *cuneata*, 165.
Quercus aquatica, α *laurifolia*, 169.
Quercus aquatica, β *heterophylla*, 180.
Quercus aquatica, γ *elongata*, 165.
Quercus aquatica, δ *indivisa*, 165.
Quercus aquatica, ε *attenuata*, 165.
Quercus aquatica, ζ ? *myrtifolia*, 123.
Quercus aquatica, var. *hybrida*, 165.
Quercus arcoglandis, 111.
Quercus Arizonica, 89.
Quercus Austriaca, 7.
Quercus Ballota, 7.
Quercus Baloot, 7.
Quercus Balout, 7.
Quercus Banisteri, 155.
Quercus berberidifolia, 111.
Quercus bicolor, 63, 67.
Quercus bicolor, β *mollis*, 63.
Quercus bicolor, β *platanoides*, 63.
Quercus bicolor, subspec. *Michauxii*, 67.
Quercus brevifolia, 171.
Quercus brevifolia × Catesbæi, 172.
Quercus brevifolia, hybrids of, 172.
Quercus breviloba, 71.
Quercus Breweri, 27.
Quercus Brittoni, 162.
Quercus, buds of, 4.
Quercus Buergerii, 11.
Quercus Bungeana, 3, 10.
Quercus calicina, 7.
Quercus Californica, 141.
Quercus Calliprinos, λ *arcuata*, 10.
Quercus Castanea, 51, 55.
Quercus Catesbæi, 143.
Quercus Catesbæi × *aquatica*, 144.
Quercus Catesbæi × laurifolia, 144.
Quercus Catesbæi × nigra, 144.
Quercus Cerris, 3, 7.
Quercus Cerris, buds of, 4.
Quercus Cerris denticulata, 7.
Quercus Cerris Fulhamensis, 7.
Quercus Cerris, hybrids of, 5.
Quercus Chapmani, 41.
Quercus Chincapin, 59.
Quercus Chinensis, 10.
Quercus chrysolepis, 105.
Quercus chrysolepis, 109.
Quercus chrysolepis, subspec. Palmeri, 107.
Quercus chrysolepis, subspec. vacciniifolia, 106.
Quercus cinerea, 171.
Quercus cinerea, β *dentato-lobata*, 171.
Quercus cinerea, γ *humilis*, 171.
Quercus cinerea, var. *pumila*, 115.
Quercus coccifera, 3, 10.
Quercus coccifera, ζ Palestina, 10.
Quercus coccinea, 133.
Quercus coccinea, 129.
Quercus coccinea, α *coccinea*, 133.
Quercus coccinea β, 125.
Quercus coccinea, β *nigrescens*, 137.
Quercus coccinea, γ *tinctoria*, 137.
? *Quercus coccinea*, δ *Rugelii*, 137.
Quercus coccinea, var. *ambigua*, 125.
Quercus coccinea var. ? *microcarpa*, 129.
Quercus coccinea × *ilicifolia*, 156.
Quercus confertifolia, 117.
Quercus crassipocula, 105.
Quercus crinita, 7.
Quercus crispula, 6.
Quercus Cubana, 99.
Quercus cuneata, 147.
Quercus cuspidata, 4, 11.
Quercus decipiens, 91.
Quercus densiflora, 183.
Quercus densiflora, 183.
Quercus densiflora, var. echinoides, 183.
Quercus dentata, 3, 10.
Quercus digitata, 147.
Quercus dilatata, 3, 6.
Quercus discolor, 137, 147.
Quercus discolor, γ *Banisteri*, 155.
Quercus Douglasii, 79.
Quercus Douglasii, β ? *Gambelii*, 33.
Quercus Douglasii, γ *Novomexicana*, 33.
Quercus Douglasii, var. *Necæi*, 29.
Quercus Drummondii, 37.
Quercus dumosa, 95.
Quercus dumosa, γ *acutidens*, 95.
Quercus dumosa, var. *bullata*, 96.
Quercus dumosa, var. *munita*, 95.
Quercus dumosa, var. *polycarpa*, 95.
Quercus dumosa, var. revoluta, 96.
Quercus Dunnii, 107.
Quercus Durandii, 71.
Quercus echinacea, 183.
Quercus echinoides, 183.
Quercus, economic properties of, 3.
Quercus elongata, 147.
Quercus Emoryi, 103.
Quercus Emoryi, 75, 89.
Quercus Engelmanni, 83.
Quercus Esculus, 7.
Quercus expansa, 7.
Quercus falcata, 147.
Quercus falcata, β *Ludoviciana*, 147.
Quercus falcata, β *triloba*, 147.
Quercus falcata, var. b *pagodæfolia*, 147.
Quercus Fendleri, 75.
Quercus ferruginea, 161.
Quercus fulvescens, 105.
Quercus, fungal diseases of, 4, 12.
Quercus Gambelii, 33.
Quercus Gambelii, var. *Gunnisonii*, 33.
Quercus Garryana, 29.
Quercus Garryana, dwarf form of, 30.
Quercus Georgiana, 159.
Quercus Georgiana × Marilandica, 159.
Quercus Georgiana × *nigra*, 159.
Quercus, germination of, 4.
Quercus Gilberti, 29.
Quercus glabra, 4, 11.
Quercus glauca, 4, 11.
Quercus Gramuntia, 7.
Quercus Griffithii, 3, 6.
Quercus grisea, 75, 89.
Quercus grosseserrata, 6.
Quercus hastata, 103.
Quercus hemisphærica, 165.
Quercus hemisphærica, var. *nana*, 165.
Quercus heterophylla, 180.
Quercus Hindsii, 23.
Quercus humilis, 171.
Quercus, hybrids, 5.
Quercus hypoleuca, 117.
Quercus Ilex, 3, 7.
Quercus Ilex, γ Ballota, 7.
Quercus Ilex, var. Ballota, 3.
Quercus Ilex suberosa, 8.
Quercus ilicifolia, 155.
Quercus ilicifolia × *coccinea*, 156.
Quercus imbricaria, 175.
Quercus imbricaria, β *spinulosa*, 175.
Quercus imbricaria × *coccinea*, 176.
Quercus imbricaria × Marilandica, 176.
Quercus imbricaria × *nigra*, 176.
Quercus imbricaria × palustris, 177.
Quercus imbricaria × velutina, 176.
Quercus incana, 3, 10.
Quercus infectoria, 9.
Quercus, insect enemies of, 4, 11.
Quercus Ithaburensis, 8.
Quercus, its increase in North America, 5.
Quercus Jacobi, 29.
Quercus Kelloggii, 141.
Quercus lanata, α *incana*, 10.

Quercus laurifolia, 169.
Quercus laurifolia, α *acuta*, 169.
Quercus laurifolia, β *obtusa*, 169.
Quercus laurifolia hybrida, 169.
Quercus Leana, 176.
Quercus lobata, 23.
Quercus lobata, subspec. *fruticosa*, 27.
Quercus lobata, var. *Breweri*, 27.
Quercus lobata, var. *Hindsii*, 23.
Quercus longiglanda, 23.
Quercus Lusitanica, 3, 6.
Quercus Lusitanica, α *genuina*, 9.
Quercus Lusitanica, α infectoria, 9.
Quercus Lusitanica, subspec. Bœtica, ω Mirbeckii, 6.
Quercus lyrata, 47.
Quercus MacDonaldi, 95.
Quercus MacDonaldi, var. *elegantula*, 95.
Quercus macrocarpa, 43.
Quercus macrocarpa, β *abbreviata*, 43.
Quercus macrocarpa, γ *minor*, 43.
Quercus macrocarpa, var. *olivæformis*, 43.
Quercus macrolepis, 8.
Quercus marginata, 11.
Quercus Marilandica, 161.
Quercus Marilandica × nana, 162.
Quercus maritima, 100.
Quercus, medical properties of, 3.
Quercus Mexicana, γ *confertifolia*, 117.
Quercus Michauxii, 67.
Quercus minor, 37.
Quercus minor × alba, 38.
Quercus Mirbeckii, 6.
Quercus Mongolica, 3, 6.
Quercus montana, 51.
Quercus Morehus, 120.
Quercus Muehlenbergii, 55.
Quercus Muehlenbergii, var. *humilis*, 59.
Quercus myrtifolia, 123.
Quercus nana, 155.
? *Quercus nana*, 165.
Quercus nana × coccinea, 156.
Quercus nana × velutina, 156.
Quercus Necœi, 29.
Quercus nigra, 165.
Quercus nigra, 8, 137, 161.
Quercus nigra, α *aquatica*, 165.
Quercus nigra β, 161.
Quercus nigra, β *latifolia*, 161.
Quercus nigra, β *quinqueloba*, 161.
Quercus nigra, β *tridentata*, 176.
? *Quercus nigra*, γ *sinuata*, 144.
Quercus nigra digitata, 147.
Quercus nigra integrifolia, 161.
Quercus nigra trifida, 165.
Quercus nigra, var., 180.
Quercus oblongifolia, 87.
Quercus oblongifolia, 75, 83.
? *Quercus oblongifolia*, 79.
Quercus oblongifolia, var. *brevilobata*, 79.
Quercus obtusa, 169.
Quercus obtusifolia, var. ? *breviloba*, 71.
Quercus obtusiloba, 37.
Quercus obtusiloba, var. *parvifolia*, 41.
Quercus obovata, 10.
Quercus occidentalis, 3, 9.
? *Quercus Œrstediana*, 27, 29.
Quercus oleoides, 99.
Quercus olivæformis, 43.
Quercus oxyadenia, 111.
Quercus Palestina, 10.
Quercus Palmeri, 107.
Quercus palustris, 151.
Quercus palustris, 129.
Quercus palustris, β *cucullata*, 151.
Quercus parvula, 119.
Quercus pedunculata, 6.
Quercus Persica, 8.
Quercus Phellos, 179.
Quercus Phellos, α *longifolia*, 179.
Quercus Phellos, α *viridis*, 179.
Quercus Phellos β, 99, 171.
Quercus Phellos, β *brevifolia*, 171.
Quercus Phellos, β *humilis*, 171.
Quercus Phellos, β *imbricaria*, 175.
Quercus Phellos, β *latifolia*, 171.
Quercus Phellos, β *sericea*, 171.
Quercus Phellos, β *subimbricaria*, 181.
Quercus Phellos, c, 99.
Quercus Phellos, γ *obtusifolia*, 99.
Quercus Phellos, δ *subrepanda*, 179.
Quercus Phellos, ε *nana*, 115.
Quercus Phellos, ε *sublobata*, 179.
Quercus Phellos (*maritima*), 100.
Quercus Phellos (*pumila*), 115.
Quercus Phellos sempervirens, 99.
Quercus Phellos (*sylvatica*), 179.
Quercus Phellos, var., 180.
Quercus Phellos, var. *arenaria*, 123.
Quercus Phellos, var. *laurifolia*, 169.
Quercus Phellos × *coccinea*, 180.
Quercus Phellos × *ilicifolia*, 181.
Quercus Phellos × Marilandica, 181.
Quercus Phellos × nana, 181.
Quercus Phellos × *nigra*, 181.
Quercus Phellos × *rubra*, 180.
Quercus Phellos × *tinctoria*, 180.
Quercus Phellos × velutina, 180.
Quercus pinnatifida, 10.
Quercus platanoides, 63.
Quercus prinoides, 59.
Quercus prinoides, 55.
Quercus Prinus, 51.
Quercus Prinus, 67.
Quercus Prinus acuminata, 55.
Quercus Prinus Chincapin, 59.
Quercus Prinus discolor, 63.
Quercus Prinus humilis, 59.
Quercus Prinus (*Monticola*), 51.
Quercus Prinus (*palustris*), 67.
Quercus Prinus (*pumila*), 59.
Quercus Prinus tomentosa, 63.
Quercus Prinus, α *lata*, 51.
? *Quercus Prinus*, α *parvifolia*, 51.
Quercus Prinus, β *bicolor*, 63.
? *Quercus Prinus*, β *oblongata*, 51.
Quercus Prinus, β *platanoides*, 63.
Quercus Prinus, var. *discolor*, 67.
Quercus Prinus, var. *Michauxii*, 67.
Quercus Pryami, 8.
Quercus pseudo-coccifera, 10.
Qnercus pubescens, 8.
Quercus pumila, 115.
Quercus pumila, var. *sericea*, 115.
Quercus pungens, 75.
Quercus Pyrenaica, 8.
Quercus Ransomi, 79.
Quercus reticulata, 91.
? *Quercus reticulata*, β *Greggii*, 91.
Quercus retusa, 99.
Quercus Robur, 3, 6.
Quercus Robur, 6.
Quercus Robur pedunculata, 6.
Quercus Robur, subspec. pedunculata, 6.
Quercus Robur, subspec. sessiliflora, 6.
Quercus rotundifolia, 7.
Quercus rubra, 125.
Quercus rubra, 129, 141, 147.
Quercus rubra, α *latifolia*, 125.
Quercus rubra, a *viridis*, 125.
Quercus rubra, b, 125.
Quercus rubra, β, 125, 147.
? *Quercus rubra*, β *coccinea*, 133.
Quercus rubra, β *Hispanica*, 147.
Quercus rubra, β *runcinata*, 126.
Quercus rubra, c *Schrefeldii*, 125.
? *Quercus rubra*, γ *Mühlenbergii*, 125.
? *Quercus rubra*, γ *subserrata*, 125.
Quercus rubra, d *heterophylla*, 125.
Quercus rubra, e *aurea*, 125.
Quercus rubra dissecta, 151.
Quercus rubra maxima, 125.
Quercus rubra montana, 125.
? *Quercus rubra montana*, 147.
Quercus rubra nana, 155.
Quercus rubra × velutina, 126.
Quercus rubra ramosissima, 151.
Quercus rubra, var. *Texana*, 129.
Quercus rubra × digitata, 126.
Quercus rubra × imbricaria, 126.
Quercus Rudkini, 181.
Quercus, saccharine exudations from, 8.
Quercus Sadleriana, 61.
Quercus Sagræana, 99.
Quercus San-Sabeana, 71.
Quercus, sections of, 4.
Quercus sempervirens, 99.
Quercus sericea, 115.
Quercus serrata, 3, 10.
Quercus serrata, 10.
Quercus serrata, ω *Chinensis*, 10.
Quercus serrata, β Roxburghii, 10.
Quercus sessiliflora, 6.
Quercus sessiliflora, var. *Mongolica*, 6.
Quercus Shumardii, 137.
Quercus sinuata, 144.
Quercus Sonomensis, 141.
Quercus spicata, 91.
Quercus stellata, 37, 41.
Quercus stellata, β *Floridana*, 37.
Quercus stellata, γ *depressa*, 45.
Quercus stellata, δ *Utahensis*, 33.
Quercus stolonifera, 8.
Quercus Suber, 3, 8.
Quercus Tauzin, 8.
Quercus Texana, 129.
Quercus tinctoria, 137.
Quercus tinctoria, α *angulosa*, 137.
Quercus tinctoria, α *discolor*, 137.
Quercus tinctoria, β *magnifica*, 137.
Quercus tinctoria, β *sinuosa*, 137.
Quercus tinctoria, γ *macrophylla*, 137.
Quercus tinctoria, δ *nobilis*, 137.
Quercus tinctoria, var. *Californica*, 141.
Quercus tomentella, 109.
Quercus Toumeyi, 93.
Quercus Tournefortii, 7.
Quercus Toza, 3, 7.
Quercus triloba, 147.
Quercus Trojana, 8.
Quercus turbinella, 75, 95.
Quercus uliginosa, 165.
Quercus undulata, 75.
Quercus undulata, 33, 71.
Quercus undulata, α *Gambelii*, 33.
Quercus undulata, β *obtusifolia*, 75.
Quercus undulata, γ *Jamesii*, 75.
Quercus undulata, γ *pedunculata*, 75.
Quercus undulata, δ *grisea*, 87.
Quercus undulata, δ *Wrightii*, 75.
Quercus undulata, var. *grisea*, 75, 87, 89.
Quercus undulata, var. *oblongata*, 75, 87.
Quercus undulata, var. *pungens*, 75, 95.
Quercus Ungeri, 8.
Quercus vacciniifolia, 106.

Quercus Vallonea, 8.
Quercus Vallonea β macrolepis, 8.
Quercus velutina, 137.
Quercus venustula, 33.
? Quercus villosa, 37.
Quercus virens, 99.
Quercus virens, var. *dentata*, 101.
Quercus virens, var. *maritima*, 100.
Quercus Virginiana, 99.
Quercus Virginiana, var. maritima, 100.
Quercus Virginiana, var. minima, 101.
Quercus Wislizeni, 119.
Quercus Wislizeni, var. *frutescens*, 119.
Quercus Wislizeni × Californica, 120.
Quercus Wislizeni × *Kelloggii*, 120.

Ravenel, Henry William, 160.
Ravenelia, 160.
Red Oak, 125, 129.
Rhizococcus Quercus, 11.
Robur, 4.
Rock Chestnut Oak, 51.
Rock Oak, 56.
Rothrock, Joseph Trimble, 92.
Running Oak, 115.

Sadler, John, 62.
Sand Jack, 172.
Saul's Oak, 18.
Scarlet Oak, 129.
Scrub Oak, 75, 95, 123, 145, 155.
Selandria Quercus-alba, 12.
Seventeen-year Cicada, 11.
Shii-take, cultivation of, 11.
Shin Oak, 27, 33, 75.
Shingle Oak, 175.
Silk-worms, Oak, 3.
Spanish Oak, 147.
Sphærotheca lanestris, 13.
Suber, 4.
Swamp Spanish Oak, 151.
Swamp White Oak, 47, 63.
Syncedris, 1.

Tan-bark, 6.
Tan Bark Oak, 183.
Taphrina cœrulescens, 13.
Tauzin, 8.
Telea Polyphemus, 12.
Tetranychus telarius, 12.
Tortrix quercifoliana, 12.
Toumey, James William, 93.
Tuber brumale, 7.
Tuber melanosporum, 7.
Turkey Oak, 143.

Upland Willow Oak, 172.
Uredo Quercus, 13.

Valley Oak, 23.
Valonia, 8.
Valonia Oak, 8.
Venturia Orbicula, 13.

Wadsworth Oak, the, 63.
Water Oak, 165, 169, 181.
White Oak, 16, 23, 29, 33, 71, 87, 89.
White Oak, Evergreen, 83.
White Oak, Swamp, 47, 63.
Willow Oak, 179.
Willow Oak, Upland, 172.
Woodhouse, Samuel Washington, 88.

Yellow Oak, 55, 127, 139.
Yellow-bark Oak, 139.

Zéen, the Algerian, 6.

New York Botanical Garden Library
3 5185 00287 8849